

**Report of Physics Olympiad Exposure Camp
CESME, HBCSE**

Date: December 02-06, 2019



Homi Bhabha Centre for Science Education

Tata Institute of Fundamental Research

December 2019

Physics Olympiad Exposure Camp 2019

held at HBCSE from 2 to 6 December, 2019

The Physics Olympiad Exposure Camp is conducted with an idea of spreading the awareness of the Olympiad programme as well as to give a flavour of the academic challenge to the teacher community of the country. This year the camp was conducted from 2 December 2019 to 6 December 2019, as part of CESME (HBCSE) activities of MHRD. In all 41 teachers (out of 66 invited) participated in the camp. These teachers ranged from higher secondary school to undergraduate level. The camp focused on different aspects of theoretical and experimental components of the Physics Olympiad programme. It also introduced the teachers to physics education research. This report describes various sessions conducted by various resource persons.

Session 1: Introduction to Olympiad program- Prof. Anwesh Mazumdar (1 lecture)

Prof. Mazumdar introduced the participants to the structure of the Olympiad programme in India and at the international level. It included brief academic introduction to three stage selection of the team of students to represent India in international Olympiad and teachers' role in the whole programme.

Session 2: Introduction to Electromagnetism – Prof. H.S. Mani (2 lectures)

Prof. Mani started the session with the basics of electrostatics, i.e., the lines of force, charge distribution and principle of superposition. He gave a brief explanation about the field in parallel plate capacitors and spherical conductors.

In his second talk, Prof. Mani gave some problems related to electromagnetism and the participants were asked to solve them. The problems mostly included Faraday's law. During solving of the problems, he also introduced some concepts like transformer emf and motional emf which helped participants to understand the concept better. For one of the problems on Faraday's law, a demonstration was shown to the participants.

Session 3: Physics with Smartphone – Dr. Praveen Pathak (2 sessions)

In this session, Dr. Pathak introduced a new approach towards learning physics with the smartphone. He initially gave the introduction to one of the online polling websites **socratic.com** where the questions can be posted by the teacher and the answers from the students can be recorded immediately. He also introduced the participants to two physics related applications, Phyphox and Science Journal, which use the various sensors present in a smartphone.

Dr. Pathak showed some demonstrations related to Doppler effect in free fall, inclined plane and circular motion. In each of the demonstrations he showed how measurements using the smartphone can be used to determine unknown quantities in the experiments. At the end of the talk he gave a small demonstration on the gyroscope with the help of a bicycle wheel and a fidget spinner.

Session 4: Physics Olympiad Experiments- Mr. Shirish Pathare (1 lecture + 1 Lab session)

The participants were given a task to find out the value of acceleration due to gravity by using the simple pendulum. While the participants were completing the task, their work was closely observed. A discussion was carried out on the common mistakes that happen while doing the experiments. He also gave brief introduction to the process of developing experiments for Olympiads in HBCSE.

On the second day of the camp, the teachers participated in laboratory sessions, performing two activities in groups of two:

1. Optical black box – where they had to find the components and their position in the black box by passing laser through different open windows of the black box.
2. Young's modulus using wind chimes – determination of the velocity of sound in aluminum and hence calculation of its Young's modulus.

Session 5: Low cost Instrumentation – Mr. Shirish Pathare

In this session, Mr. Pathare introduced the participants to the alternative instruments for very costly instruments. It included Hall Effect IC for magnetic field measurement, low cost lasers, mica band heaters and wire wound resistors as heaters. He also showed some simple and low-cost methods to make apparatus like timer, signal generator, photo-gate, Michelson interferometer.

Session 6: Scaling laws and Dimensional Analysis – Prof. Vijay Singh

Prof. Singh started the talk by introducing the concept of numeracy and evolution of information age from 'small scale information (SSI)' in 1965 to today's 'Ultra Large Scale Information', which is an exponential increase. Later he discussed the topic of dimensional analysis and how an equation can be derived by this, with many examples.

In his second talk, Prof. Singh introduced Buckingham's theorem on dimensional analysis with some examples. He also discussed a KVPY problem based on a hanging stick which included several concepts like centre of mass, friction law and resonance through open pipe.

Session 7: Physics Education Research in Thermodynamics – Mr. Shirish Pathare

In this session, Mr. Pathare gave brief introduction to the work he has done in Physics Education Research in the field of elementary thermodynamics. He explained the alternative conceptions that students have in thermodynamics, i.e., heat as fluid, or heat as energy content of the system. Activities based on adiabatic compression and isothermal compression, related to, the first law of thermodynamics was given to the groups.

Session 8: Concepts in Mechanics – Prof. Anwesh Mazumdar

In this session, Prof. Mazumdar posed questions based on the concepts of Mechanics on socrative.com and the answers from the participants were discussed for each question. The discussion focused around the possible misconceptions that one has. The questions were mostly based on Newton's laws of motion.

Session 9: Olympiad problem solving

Participants were given some problems from past national and international Olympiads to solve and the answers for them were discussed. Some of the Junior Science Olympiad problems were also discussed in the session by Prof. Mazumdar and Dr. Pathak. One of the problems on buoyancy was experimentally verified by Dr. Pathak.

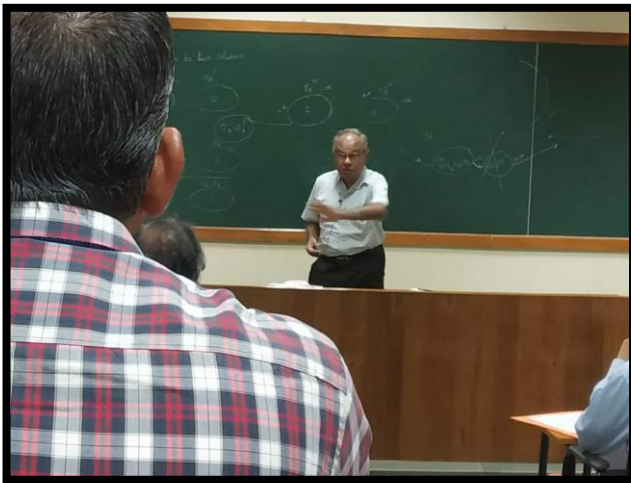
Session 10: Presentations by Participants

Participants gave presentations on theoretical and experimental problems made by them in groups of four.

At the end, certificates were distributed to the participants and some of them gave oral feedback about the whole programme. Apart from this, detailed written feedback was collected from all participants.

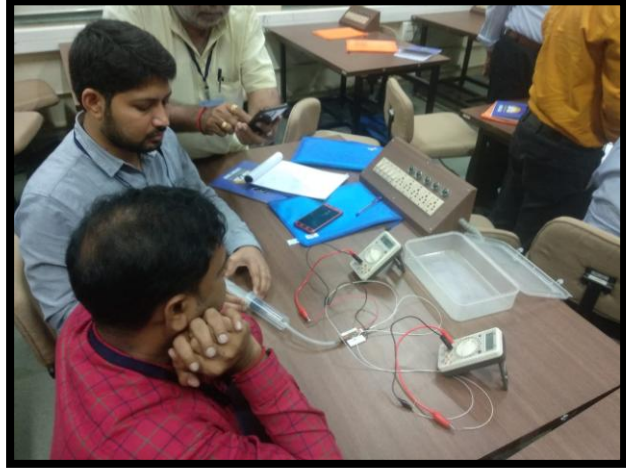
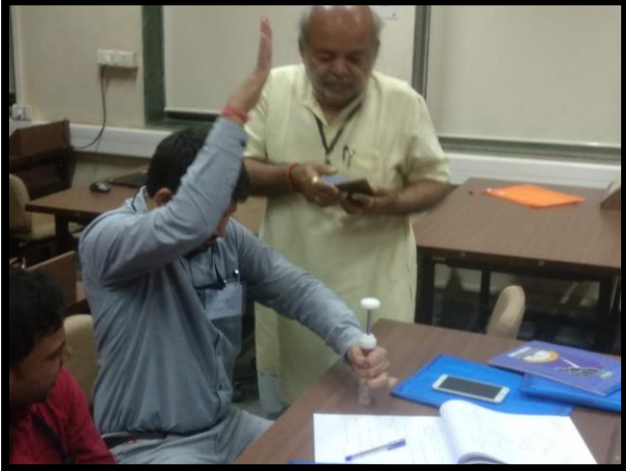
Photographs of various sessions:

Classroom sessions

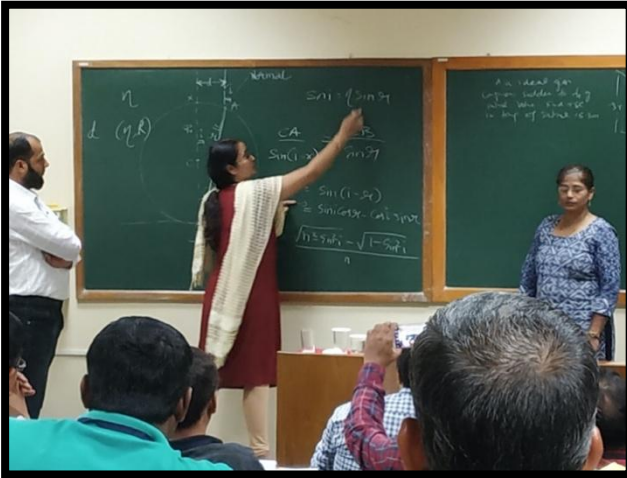


Laboratory Sessions





Presentation by participants



Annexure A - Time table of the workshop

**Homi Bhabha Centre for Science Education
Physics Olympiad Teachers Exposure Camp
December 2 - 6, 2019
Venue - NIUS G4**

Schedule

Date	Time	Speaker	Title
Dec 2	9:00 - 9:30		Registration
	9:30 - 10:30	AM	Introduction to Olympiads
	10:30 - 11:00		Tea
	11:00 - 12:30	HSM	Concepts in Electromagnetism
	12:30 - 13:30		Lunch
	13:30 - 15:00	PP	Physics with a Smartphone
	15:00 - 15:15		Tea
	15:15 - 18:00	SRP	Physics Olympiad Experiments
	18:00 - 18:30		Snacks
Dec 3	9:00 - 10:30	HSM	Concepts in Electromagnetism
	10:30 - 11:00		Tea
	11:00 - 12:30	PP	Physics with a Smartphone
	12:30 - 13:30		Lunch
	13:30 - 15:00	SRP	Physics Olympiad Experiments
	15:00 - 15:15		Tea
	15:15 - 17:30	SRP	Physics Olympiad Experiments
	18:00 - 18:30		Snacks
Dec 4	9:00 - 10:30	SRP	Low Cost Instrumentation
	10:30 - 11:00		Tea
	11:00 - 12:30	VS	Scaling and Dimensional Analysis
	12:30 - 13:30		Lunch
	13:30 - 15:00	VS	Derive, Demonstrate and Deduce
	15:00 - 15:15		Tea
	15:15 - 17:30	SRP	PER in Thermodynamics
	17:30 - 18:00		Snacks
Dec 5	9:30 - 11:00	AM	Concepts in Mechanics
	11:00-11:30		Tea
	11:30-13:00	AM	Concepts in Mechanics
	13:00-14:00		Lunch
			Free Time
Dec 6	9:30 - 11:00		Olympiad Problem Solving
	11:00 - 11:30		Tea
	11:30 - 13:00		Participants' Presentations
	13:00 - 14:00		Lunch
	14:00 - 15:15		Participants' Presentations
	15:15 - 15:30		Tea
	15:30 - 16:30		Feedback and Valedictory Session

Resource Persons:

AJ	Avinash Jadhav	AM	Anvesh Mazumdar
BL	Bhagyashri Latade	DD	Dhawal Dalvi
HSM	H S Mami	PP	Praveen Pathak
SRP	Shirish Pathare	VS	Vijay Singh
YP	Yogita Patel	SS	Sadashiv Shirodkar
VK	Vinayak Katdare		

Annexure B - List of participants

Sr No.	Name	Gender	Affiliation	School/College
1	Abhijit Poddar	M	Associate Professor	Surendranath Evening College, Kolkata
2	Achintya Pal	M	Exploration Geophysicist and Physics Teacher	Secretary, IAPT, RC - 15
3	Anand Bhalchandra Parulekar	M	Teacher	Shri Bhumika Higher Secondary School, Parye, Sattari, Goa
4	Anand Singh Rana	M	Teacher	Shri Guru Ram Rai P G College, Dehradun
5	Anindya De	M	Teacher	Hindu School
6	Anirvan B. Gupta	M	Teacher	Smt. Devkiba Mohansinhji Chauhan College of Commerce and Science (Affiliated to University of Mumbai)
7	Ankit Singh Chouhan	M	Research Scholar	Shri Vaishnav Vidhyapeeth Vishwavidyalaya
8	Biplab Das	M	Teacher	Gomakpota Gunadhar Vidyamandir (H.S)
9	Biresh Chandra Layek	M	Teacher	Nigamnagar N. S. High School (H. S.)
10	Chanda Nagaraju	F	Teacher in physics	Zilla Parishad Highschool Brahmanagudem
11	Foran Chand	M	Science Teacher	Govt. High School Dasgrain
12	Krishan Kumar	M	Teacher	Royal International School
13	Monali Poddar	F	Assistant Professor	Maharaja Manindra Chandra College, Kolkata
14	Mukul Sharma	M	Teacher	Vivek High School, Chandigarh
15	Nidhi Tendulker	F	Teacher	DCT's Vasant Rao Dempo Higher Secondary School, Cujira
16	Nilangshu Acharya	M	Assistant Professor of Mathematics	P.R. Thakur Govt. College
17	Pramod Kumar Parashar	M	Teacher/ Lecturer (physics)	M. I. Inter College, Sikandra Rao, Hathras
18	Pratap Kumar Banua	M	Teacher	Kharagpur Atulmoni Polytechnic High (H.S) School
19	Rajan Bharti	M	Master	H S S Chiryai
20	Ranjeet Kumar	M	Teacher	Govt.High School Hathal

21	Rehan Ahmed	M	Teacher	Sir Sayyed College Of Arts, Commerce And Science
22	Sanjoy Kumar Pal	M	Assistant Teacher	Anandapur H.S. School
23	Sant Pal Singh	M	Lecturer Physics	Yuvraj Dutt Inter College, Oel, Lakhimpur - Kheri
24	Santosh Behera	M	Teacher	Govt. Science College, Chhatrapur
25	S K. Ameer	M	Teacher	Srinidhi High School
26	Snehal Choudhary	F	Teacher	Abasaheb Garware College, Pune
27	Soumen Sarkar	M	Assistant Teacher	Karui P.C. High School (H.S.)
28	Sukumar Bera	M	Teacher(Head Master)	Madpur High School (H.S)
29	Sushant Yadav	M	Teacher	RPS Public School
30	Vijay Kumar	M	Professor And Dean Allied Sciences	Graphic Era Hill University Dehradun Utrtrahand
31	Punarbasa Bose	M	Assistant Professor	Hooghly Women's College
32	Riyaz Wani	M	Lecturer 10+2	Govt Girls Hr. Secondary Panzgan
33	Sindhe Anuradha	M	Teacher	Vedham High School
34	Vanitha Anathula	F	Physics Lecturer	TSSA KGBV
35	Brajesh Dixit	M	Principal	Sri Narayan Inter College, Badera (Auraiya) U. P
36	Dilip Thakur	M	Head Of Dept Physics	Ashoka Universal School
37	G S Menaria	M	Pgt	St Teresa Sr Sec School
38	Mrunalini Deshmukh	F		Reliance Foundation School EM Lodhivali
39	Mushtaq Bashir	M	Lecturer 10+2	Govt Hr Secondary School Ganderbal
40	Nusrat Fayaz	F	Lecturer 10+2	Govt Hr. Secondary School Bijbehara
41	Vimalkumar T V	M	Teacher	St. Thomas College, Thrissur, Kerala