HOMI BHABHA CENTRE FOR SCIENCE EDUCATION TATA INSTITUTE OF FUNDAMENTAL RESEARCH and NATIONAL BOARD FOR HIGHER MATHEMATICS DEPARTMENT OF ATOMIC ENERGY GOVERNMENT OF INDIA

2017-2018

Mathematical Olympiad Programme in India

Leading to participation in International Mathematical Olympiad

Homi Bhabha Centre for Science Education Tata Institute of Fundamental Research

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MATHEMATICAL OLYMPIAD PROGRAMME IN INDIA AND RELATED ACTIVITIES

The Mathematical Olympiad Programme in India is organized by the Homi Bhabha Centre for Science Education (HBCSE) on behalf of the National Board for Higher Mathematics (NBHM) of the Department of Atomic Energy (DAE), Government of India.

Apart from the International Mathematical Olympiad (IMO), in which India is participating since 1989, since 2015 we have also started participating in two more international Olympiad events: the European Girls' Mathematical Olympiad (EGMO) and Asian Pacific Mathematics Olympiad (APMO). The process for selection of students for participation in the events have been merged, taking into account the requirements of the individual tests.

Team Selection and Training Process

For the purpose of training and selection of students for the Olympiad contest, 25 regions all over the country have been designated and each assigned a Regional Coordinator. Additionally, three groups (Central Board of Secondary Education (CBSE), Navodaya Vidyalaya Samiti (NVS) and Kendriya Vidyalaya Sangathana (KVS) have a 'Regional Coordinator' each.

The process for selection to IMO team involves the following steps. These steps will now be applicable also to EGMO and APMO, along the lines indicated below.

Step 1: Pre- Regional Mathematical Olympiad (PRMO)

The pre-Regional Mathematical Olympiad (PRMO) is a two and half hour examination with 30 questions. The answer to each question is either a single digit number or a two digit number and will need to be marked on a machine readable OMR response sheet. The PRMO question paper will be in English and Hindi.¹

Step 2: Regional Mathematical Olympiad (RMO)

The RMO is a three hour written test with six problems. On the basis of the performance in RMO, up to 30 students from each region are selected for Stage 2 (INMO). In case of a tie for the closing ranks, a tie-breaking mechanism shall be applied by the regional coordinator, following appropriate norms, to arrive at the final list of maximum 30 students from the region.

At the time of the publication of the brochure, the PRMO has been completed.

In the context of participation in EGMO it is decided that up to five girls be additionally selected apart from the general quota of 30 students for each region. This provision is independent of the number of girls who may be part of the list of 30 students from the region.

The RMO will be held in all the regions on Sunday, 8thOctober, 2017 between 1.00 p.m. and 4.00 p.m.

The results of RMO for all the regions are to be declared centrally by HBCSE on or before 7th December, 2017. Therefore the regional coordinators should send the final results to HBCSE by 30th November, 2017. The regional coordinators shall not declare the results in their respective regions prior to that date. However, to enable students to apply for re-evaluation the regional coordinators must inform the students personally of their performances. The students must be given a period of 10 days to submit re-evaluation request. Thereafter the re-evaluation should be conducted and the results of RMO should be finalised.

Eligibility: All students who qualify in the PRMO 2017 conducted by the Indian Association of Physics Teacher (IAPT) on August 20, 2017 are eligible to appear in RMO 2017.

Step 2: Indian National Mathematical Olympiad (INMO). The INMO will be held on the **third Sunday of January (January 21, 2018) from 12.00 noon to 4.00 p.m.** Only those students who are selected in RMO 2017 and those who have received an INMO certificate of merit in 2017 are eligible to appear for the INMO provided they are in class XI or below. This contest is a four hour written test. On the basis of the INMO, the top 30 students in merit from all over the country will be chosen as INMO awardees. In addition to INMO awardees, the next 45 students who are in class XI or lower and have performed well in INMO, but have not qualified as INMO awardee, are awarded INMO certificate of merit. These students will be eligible to appear for INMO 2019 directly without qualifying through RMO 2018, provided they are not in class XII at the time of writing INMO.

In addition to the 30 students in the list of INMO awardees as above, up to five girl students (outside the INMO awardees list) will be chosen based on the performance in INMO, for training and possible selection in EGMO 2019 team.

All INMO awardees, the selected girl students as above and all the students designated as senior students of IMOTC 2018 will be eligible to write APMO. The APMO tests will be held in the respective regions in the first half of March 2018.

The INMO results will be declared on or before February 28, 2018.

Step 3: International Mathematical Olympiad Training Camp (IMOTC). The INMO awardees and the girls selected from INMO for training are invited to a month long training camp in April-May each year at the Homi Bhabha Centre for Science Education (HBCSE), Mumbai. Besides, the INMO awardees from the previous years and the selected girl students of the previous years who are eligible for IMO-2018/EGMO-2019 and have gone through postal tuition throughout the year satisfactorily are invited to the training camp as senior students. An INMO awardee who has completed one year of 12th standard will not be eligible for the next year's IMOTC.

The junior students will receive INMO certificate and a prize in the form of books. The senior students will receive a prize in the form of books and cash.

On the basis of a number of selection tests during the Camp, a team of the best six students is selected from the combined pool of junior and senior batch participants as the IMO 2018 Team.

A team of upto four girl students will be selected for participation in EGMO 2019, based on the performance of girl students from the combined pool at IMOTC.

Step 4: Pre-Departure Training Camps. The selected team of six students goes through another round of training and orientation for about ten days prior to departure for IMO. A Pre-departure camp will also be arranged for girl students selected for participation in EGMO 2019, at a suitable time.

Policy regarding participation in IMOTC/OCSC

The following procedure will be applied for selection of students for IMOTC.

In a given year, a student can participate in the orientation/ training/ selection of only one subject including the IMOTC and the Orientation - Cum - Selection Camp (OCSC) for the five science subjects, according to a preference order decided by the student herself/ himself. A student who qualifies in more than one subject (on the basis of her/his performance in Indian National Mathematical Olympiad (INMO) or INO) will be invited to the IMOTC/OCSC that is ranked highest in her/his preference list.

The procedure is as follows:

 Before INMO/INO: A student who qualifies to appear in more than one subject in INMO/INO will be asked to arrange the subjects in order of preference of attending the IMOTC/OCSC (and therefore competing for selection in the international team). This will not affect in any way the evaluation of her/his INMO/INO performance in any subject.

 After INMO/INO: A target number of students will be invited to the IMOTC/OCSC camp of each subject. The students in each subject will be assigned a rank according to her/his performance in the respective INMO/INO. If a student obtains qualifying marks in INMO/INO in multiple subjects, she/he will be included only in the IMOTC/OCSC for the subject which figures highest in her/his preference list among the subjects in which she/he has obtained qualifying marks. Her/his name will not be considered for IMOTC/OCSC in the other subjects, and the next students in those subjects will be considered, till the target number of students is reached in each subject.

Some Details Concerning the Tests

International Mathematical Olympiad (IMO). The six member team selected at the end of IMOTC accompanied by a leader, a deputy leader and observers represent the country at the IMO, held in July each year in a different member country of the IMO. The IMO contest consists of two written tests held on two consecutive days. On each day of the contest the test consists of three problems and lasts for four and half hours. India has been participating in the IMO since 1989. Students of the Indian Team who receive gold, silver and bronze medals at the IMO receive a cash prize of Rs. 5000/-, Rs. 4000/- and Rs. 3000/- respectively at a formal ceremony at the end of the training camp during the following year. The medalists also receive a cash prize of Rs. 15000/- from the Infosys Foundation.

The selection of the members of the Indian team for IMO will be subject to their fulfilling criteria such as age limit, medical fitness, parental consent, etc., as may be applicable. In particular, the selected students need to have a valid Indian passport meeting the visa regulations of the host country.

Students aiming to go through the Mathematical Olympiad programme leading to international participation (IMO) should note that PRMO is the first essential step for the programme.

European Girls Mathematical Olympiad (EGMO). A team of at most four girl students selected at the end of IMOTC accompanied by a leader, a deputy leader and an observer represent the country at the EGMO, held in April each year in a different European country. The EGMO contest consists of two written tests held on two consecutive days. On each day of the contest the test consists of three problems and lasts for four and half hours. India has been participating

in the EGMO since 2015.

The selection of the members of the Indian team for EGMO will be subject to their fulfilling criteria such as age limit, medical fitness, parental consent, etc., as may be applicable. In particular, the selected students need to have a valid Indian passport meeting the visa regulations of the host country.

Students aiming to go through the Mathematical Olympiad programme leading to participation in EGMO should note that PRMO is the first essential step for the programme.

Asian Pacific Mathematics Olympiad (APMO). APMO is a contest specifically held for students in Asian countries and the countries in the rim of Pacific ocean. There is a senior coordinating country which coordinates this examination. The advantage of this contest is that one can participate in it being in his/her country. India has started participating in APMO from 2015. The contest consists of solving 5 problems in four hours.

The requirement for participation in APMO is like IMO: one should not have entered university and must be below the age of 20 years. Besides, the contestants should have been selected through a national selection process. In view of this, all the INMO-2018 awardees and all the senior batch students for the year 2018 are eligible to write APMO-2018. Generally, it is on the second Monday of March and the following Tuesday in some countries. (For the exact date and timings of the contest, see HBCSE website.)

The students can take their examination in their respective regions. The regional coordinator will conduct the test in his or her region.

Syllabus for Mathematical Olympiad: The syllabus for Mathematical Olympiad (pre-regional, regional, national and international) is pre-degree college mathematics. The areas covered are arithmetic of integers, geometry, quadratic equations and expressions, trigonometry, co-ordinate geometry, system of linear equations, permutations and combination, factorisation of polynomial, inequalities, elementary combinatorics, probability theory, number theory, finite series, complex numbers and elementary graph theory. The syllabus does not include calculus and statistics. The major areas from which problems are given are algebra, combinatorics, geometry and number theory . The syllabus is in a sense spread over Class XI to Class XII levels, but the problems under each topic involve high level of difficulty and sophistication. The difficulty level increases from RMO to INMO to IMO.

A good idea of what is expected of students in mathematical Olympiad can be had from the question papers of earlier years (which are available at http://olympiads.hbcse.tifr.res.in/how-to-prepare/past-papers/) and the following

books:

1. Problem Primer for Olympiads

C R Pranesachar, B J Venkatachala and C S Yogananda (Prism Books Pvt. Ltd., Bangalore).

2. Challenge and Thrill of Pre-College Mathematics

V Krishnamurthy, C R Pranesachar, K N Ranganathan and B J Venkatachala (New Age International Publishers, New Delhi).

- An Excursion in Mathematics Editors: M R Modak, S A Katre and V V Acharya and V M Sholapurkar (Bhaskaracharya Pratishthana, Pune).
- 4. Problem Solving Strategies A Engel (Springer-Verlag, Germany).

5. Functional Equations

B J Venkatachala (Prism Books Pvt. Ltd., Bangalore).

6. Inequalities an approach through problems (texts & readings in mathematics), B J Venkatachala (Hindustan Book Agency)

7. Mathematical Circles

Fomin and others (University Press, Hyderabad). Many other interesting references may also be found in the book **An Excursion in Mathematics** mentioned above.

INMO Scholarship. The INMO awardees successfully completing IMOTC, who pursue B.Sc., or other courses adjudged by the Board to be on the same footing, with mathematics as one of the principal subjects of study, are eligible to receive a scholarship of NBHM, which is at present Rs. 4,000 per month, through the period of their undergraduate studies (subject to satisfactory progress). An enhanced scholarship would be available for pursuing masters studies in mathematics.

Results

IMO 2017 International Mathematical Olympiad

No.	Students Name	Region	Medal
1	Shubham Saha	Jharkhand	Bronze
2	Anant Mudgal	Delhi	Bronze
3	Yash Sanjeev	Uttar Pradesh	Bronze
4	Aditya Prakash	Karnataka	Honourable Mention
5	Tarush Goyal	Punjab	Honourable Mention
6	Sutanay Bhattacharya	West Bengal	Honourable Mention

EGMO 2017 European Girl's Mathematical Olympiad

No.	Students Name	Region	Medal
1.	Archi De	West Bengal	Bronze
2.	Haimoshri Das	West Bengal	Honourable Mention

APMO 2017 Asian Pacific Mathematics Olympiad

No.	Students Name	Region	Medal
1	Sutanay Bhattacharya	West Bengal	Silver
2	Shubham Saha	Jharkhand	Silver
3	Anant Mudgal	Delhi	Silver
4	Sauditya Jaiswal	Delhi	Bronze
5	Galav Kapoor	Delhi	Bronze
6	Navneel Singhal	Delhi	Bronze
7	Pulkit Sinha	Delhi	Bronze
8	Sarthak Behera	Orissa	Honourable Mention
9	Shubham Jain	Mumbai	Honourable Mention
10	Aneesh Garg	Punjab	Honourable Mention

Contact Addresses for inquiries about Mathematical Olympiad Programme

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Mathematical Olympiad Programme

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Indian Delegation for the International Girls Mathematical Olympiad (EGMO) 2017



From Left to Right: Prof. B. Sury (Deputy Leader), Ms. Pranjal Warade (Observer), Ms. Haimoshri Das, Ms. Archi De, Prof. B. J. Venkatachala (Leader)





From Left to Right: Dr. M. A. Prasad (Observer A), Mr. Shubham Sinha (Observer B), Aditya Prakash, Sutanay Bhattacharya, Anant Mudgal, Shubham Saha, Yash Sanjeev, Tarush Goyal, Prof. K. Subramaniam (Centre Director HBCSE), Prof. C. R. Pranesachar (Leader), Dr. Vaibhav Vaish (Deputy Leader)

The

Mathematical Olympiad programme is a major initiative undertaken by the National Board for Higher Mathematics. Its main purpose is to spot and encourage mathematical talent among pre-university students in the country. The programme leads to participation of Indian students at the International Mathematical Olympiad.

These are the only Olympiads that lead to participation in the international Mathematical Olympiads (IMOs). No other contests are recognised for this purpose.

This brochure gives the necessary information to all the concerned students, teachers, parents and others regarding this programme

Do India proud at the International Mathematical Olympiad 2018