

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

2019 - 2020

Mathematical Olympiad Programme in India

**Leading to participation in
International Mathematical Olympiad**

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April 2019

MATHEMATICAL OLYMPIAD PROGRAMME IN INDIA AND RELATED ACTIVITIES

The International Olympiad movement is aimed at bringing the most talented secondary and higher secondary students of the world together in a friendly competition of the highest level. The Olympiads do not lead directly to any career benefits; rather, they provide a stimulus to begin a career in science or mathematics, to undertake a lifelong journey into the realms of exciting intellectual challenges. The Olympiads are not merely competitions, they are the meeting places of the brightest young minds of the world, and many friendships forged at the Olympiads form the seeds of scientific collaboration later in life. Much like the Olympics in sports, the Olympiads are a celebration of the very best in school level science and mathematics. The Olympiad programmes globally have aimed at not just the international events, but also as national channels to enrich school educational curriculum. Even beyond the scope of the examinations, Olympiad problems provide intellectual stimulus and uncommon opportunities for teaching and learning of Mathematics and Science.

The principal aim of the Mathematical Olympiad and other Math competitions is to stimulate love and enthusiasm for mathematics. It is a healthy competitive activity that facilitates the learning of mathematical concepts, and the teaching of major strategies for problem solving. More than everything else, the purpose is to foster mathematical creativity and ingenuity, and the thrill of meeting challenges. Although a good performance in these competitions inspire a student to follow mathematics as a career, they do not substitute for regular curricula and, do not play a detrimental role in the careers of those who are not successful in the math Olympiads.

The Mathematical Olympiad Programme (MOP) 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 has been participating since 1989, it has also started participating in two more international Olympiad events: the European Girls' Mathematical Olympiad (EGMO) and Asia Pacific Mathematics Olympiad (APMO) since

2015. 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, 28 regions all over the country have been designated and each assigned a Regional Coordinator. Additionally, two groups of schools: Jawahar Navodaya Vidyalayas (JNV) and Kendriya Vidyalayas (KV) are also treated as separate regions and have a ‘Regional Coordinator’ each.

The MOP in India consists of six stages as outlined below.



The stages are described below and will also apply to participation in the EGMO and APMO as indicated.

Stage 1, Pre- Regional Mathematical Olympiad (PRMO): The pre-Regional Mathematical Olympiad (PRMO) is a three 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 available in English and Hindi versions. Students who require the Hindi version will need to indicate their choice at the time of registration for PRMO.

On the basis of performance in PRMO, up to 300 students from Classes 8, 9, 10, 11 and up to 60 students from class 12 will be selected to participate in RMO from each of the regions other than KV and JNV.

For KV and JNV, up to 5 per cent top performers from Classes 8, 9, 10, 11 and up to 1 per cent from Class 12 will be selected to participate in RMO.

In the case of all regions other than KV and JNV, the region to which a student belongs will be determined by the postal address of the school in which the student is studying. Any false information provided at the time of registration in this regard will be treated extremely seriously and will lead to immediate disqualification of the student from all subsequent stages.

Students studying in non-KV and non-JNV schools affiliated to CBSE will belong to their respective geographical regions.

The PRMO will be held on Sunday, August 11, 2019 between 10.00 am and 1.00 pm.

Candidates born on or after August 1, 2000 and studying in Class 8, 9, 10, 11 or 12, are eligible to write PRMO 2019. Further candidates must be Indian citizens. Provisionally, students with OCI cards are eligible to write the PRMO subject to conditions as explained in the para appearing under “Stage 4”.

It is the student’s responsibility to determine if she/he satisfies the eligibility norms for each stage of the mathematical olympiad. If, at

any stage, it is found that the student does not meet the eligibility norms, she/he may face disqualification from the programme.

The PRMO exam will be conducted by the Mathematics Teachers Association (MTA: <http://www.mtai.org.in>)

PLEASE DO NOT CONTACT HBCSE IN CONNECTION WITH ANY QUERIES CONCERNING THE PRMO 2019 EXAMINATION. ALL QUERIES MAY BE SENT TO THE CHIEF EXAMINATION CO-ORDINATOR, MTA, PREFERABLY BY EMAIL AT mtaprmo@gmail.com OR AT THE FOLLOWING ADDRESS.

Dr. S. Muralidharan

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The details of the process of registration for PRMO will be published on the MTA and HBCSE websites.

Stage 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 Classes 8, 9, 10, 11 and up to 6 students from Class 12 from each region are selected for Stage 3 (INMO). To break ties for the closing ranks, the PRMO score shall be applied by the regional coordinator. In case ties cannot be broken by PRMO scores also, the final list will include all candidates in the tied position.

As a special case, up to 5 students studying in KV schools outside India may be selected to appear directly for the INMO examination. The selection of these students will be done by KVS.

Further, up to five girls may be additionally selected ONLY FROM AMONG STUDENTS STUDYING IN CLASSES 8, 9, 10 and 11, 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. Girl students studying in Class 12 will not be eligible for the additional girls' quota.

The RMO will be held in all the regions on Sunday, 6th October 2019 between 1.00 p.m. and 4.00 p.m. If the PRMO cannot be held due to unavoidable extraneous circumstances, an alternative date may be announced for specific regions/centres as an exception."

The results of RMO for all the regions are to be declared centrally by HBCSE on or before 6th December, 2019. Therefore the regional coordinators should send the final results to HBCSE by 30th November, 2019. The regional coordinators shall not declare the results in their respective regions prior to that date.

Stage 3, Indian National Mathematical Olympiad (INMO) : The INMO will be held on the **third Sunday of January (January 19, 2020) from 12.00 noon to 4.00 p.m.** Only those students who are selected in RMO 2019 and those who have received an INMO certificate of merit in 2019 are eligible to appear for the INMO 2020. This contest is a four hour written test.

On the basis of the INMO, the top 30 students from Classes 8, 9, 10, 11 and the top 6 students from Class 12 in merit from all over the country will be chosen as INMO awardees. In addition to INMO awardees, the next 45 students who have performed well in INMO, but have not qualified as INMO awardees, are awarded INMO certificates of merit. These students will be eligible to appear for INMO 2021 directly without qualifying through PRMO 2020 or, subject to their satisfying other eligibility conditions.

Apart from the INMO awardees from Classes 8 to 11 as specified above, up to 5 girl students from the INMO merit list will be selected as INMO awardees under girls' quota. They are considered on par with the other INMO awardees for all purposes of eligibility. There will be no separate girls' quota for Class 12 students.

The practice of sending postal problem sets for INMO awardees will be discontinued from 2020 onwards. All the INMO awardees from Classes 8, 9, 10 and 11 selected for IMOTC 2020, will have to appear for INMO 2021

to be eligible for participation in IMOTC 2021. However, they may directly appear for INMO without going through PRMO and RMO. A separate “senior” merit list of these students based on their INMO performance will be prepared. The cut-off mark for these students will be the same as the cut-off for the INMO awardees from among the fresh (junior) INMO candidates in the general quota. Those who are over and above this cut-off from the “senior” list will be admitted to IMOTC 2021 as senior batch students.

All INMO awardees, the selected girl students as above and all the students designated as senior students of IMOTC 2020 will be eligible to write APMO. The APMO tests will be held in the respective regions.

The INMO results will be declared in the last week of February.

Stage 4, International Mathematical Olympiad Training Camp (IMOTC): The INMO awardees (including 5 awardees in the girls’ quata) are invited to a month long training camp in April-May each year at the Homi Bhabha Centre for Science Education (HBCSE), Mumbai. Besides these students, the INMO awardees from the previous years and the selected girl students of the previous year’s who are eligible for IMO-2019/EGMO-2020 and have gone through postal tuition throughout the year satisfactorily are invited to the IMOTC 2020 as senior students.

The junior students will receive the 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 2020 Team.

A team of up to four girl students will be selected for participation in EGMO 2020, based on the performance of girl students from the combined pool at IMOTC 2019.

As per the orders of the Madras High Court, students with OCI status will not be eligible for selection to the Indian team in the International Mathematical Olympiad. However, such students are provisionally

eligible for selection at ALL prior stages, up to and including the IMOTC provided they fulfill all other criteria. They are also provisionally eligible to write the selection tests at the IMOTC. This policy is subject to revision without prior notice depending on any further orders issued by the courts, or by a competent Government authority.

Stage 5, Pre-Departure Training Camps: The selected team of six students goes through another final 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 2020, 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 INMO or the Indian National Olympiads (INO) in the five science subjects, 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.
- Irrespective of selection or participation in IMOTC/OCSC, the student will receive a Certificate of Merit in every subject in which her/his score is equal to or higher than the score of the last selected student in that 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 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.

The criterion of holding a valid Indian passport is subject to revision in case of further court orders or orders by a competent Government authority with regard to eligibility of OCI card holders.

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.

Asia 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 her/his country. India has started participating in it 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 should 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-2020 awardees and all the senior batch students for the year 2020 are eligible to write APMO 2020. Generally, the APMO exam is held 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 her/his 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, factorization of polynomial, inequalities, elementary combinatorics, probability theory and number theory, finite series and 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 difficulty level increases from PRMO to RMO to INMO to IMO.

A good idea of what is expected of students in mathematical Olympiad contests can be had from the question papers of earlier years (which are available at

<http://olympiads.hbcse.tifr.res.in/subjects/mathematics/previous-question-papers-and-solutions>) 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).

3. 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.

8. Combinatorics (For Mathematical Olympiad)

S.Muralidharan, AIMER

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

EGMO 2019 **European Girl's Mathematical Olympiad**

No.	Students Name	Region	Medal
1.	Rohinee Joshi	Pune	Silver
2.	V. V. Sai Keerthana	Telangana	Bronze
3.	Anushka Aggarwal	New Delhi	Bronze

The team which will represent India at the 60th International Mathematical Olympiad 2019 is being held at Bath, United Kingdom from July 11 to July 22, 2019, consist of the following 6 students.:

International Mathematical Olympiad-2019

No.	Students Name	Region
1.	Bhavya Agrawalla	Indore, Madhya Pradesh
2.	Soumil Aggarwal	New Delhi
3.	Anubhab Ghosal	Kolkata, West Bengal
4.	Ojas Mittal	New Delhi
5.	Ritam Nag	Kolkata, West Bengal
6.	Pranjal Srivastava	Banglore, Karnataka

Contact Addresses for inquiries about Mathematical Olympiad Programme

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Queries should be sent by email only. In general, queries will not be responded to individually but via FAQs on the HBCSE mathematics olympiad webpages.

Mathematical Olympiad Programme

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From Left to Right: Prof. Mangala Gurjar (Observer 'C'), Prof. Vinod Kumar Grover (Leader), Ms. Venkata Sai Keerthana, Ms. Rohinee Joshi, Ms. Anushka Aggarwal, Prof. Shanta Laishram (Deputy Leader).

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60th International Mathematical Olympiad (IMO) 2019,Bath,UK**



From Left to Right: Prof. R.B.Bapat(observer), Mr. Bhavya Agrawalla, Mr. Soumil Aggarwal, Mr. Ritam Nag, Prof. C.R. Pranesachar (Leader), Mr. Pranjal Srivastava, Mr. Anubhab Ghosal, Mr. Ojas Mittal, Prof. Vinayak Sholapurkar (deputy Leader)

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