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# National Board for Higher Mathematics

The National Board for Higher Mathematics (NBHM) was formed by the Department of Atomic Energy, Government of India, in 1983, to foster the development of higher mathematics in the country, help in the establishment and development of mathematical centres and give financial assistance to research projects and to doctoral and post-doctoral scholars. The Board functions autonomously formulating its own budget and operating it. The Department of Atomic Energy provides the funds for the Board. The Board is reconstituted every three years. At present the Board consists of 15 members: M. S. Raghunathan (Chairman), Tata Institute of Fundamental Research, Bombay 400 005; R. Subramanian (Member Secretary), Bhabha Atomic Research Centre, Bombay 400 085; H. P. Dikshit, Pro-Vice-Chancellor, Indira Gandhi National Open University, New Delhi 110 068; S. Izhar Husain, Department of Mathematics, Aligarh Muslim University, Aligarh 202 002; M. Lakshmanan, Department of Physics, Bharathidasan University, Tiruchirapalli 620 024; M. G. Nadkarni, Department of Mathematics, University of Bombay, Bombay 400 098; K. R. Parthasarathy, Indian Statistical Institute, 7, S. J. S. Sansanwal Marg, New Delhi 110 016; I. B. S. Passi, Department of Mathematics, Panjab University, Chandigarh 160 014; Gopal Prasad, Tata Institute of Fundamental Research, Bombay 400 005; Phoolan Prasad, Department of Mathematics, Indian Institute of Science, Bangalore 560 012; Ashoke Roy, Indian Statistical Institute, 203, B. T. Road, Calcutta 700 035; C. S. Seshadri, SPIC Science Foundation, East Coast Chambers, III Floor, 92, G. N. Chetty Road, Madras 600 017; M. P. Singh, Centre for Atmospheric Sciences, Indian Institute of Technology, New Delhi 110 016; A. M. Vaidya, Department of Mathematics, Gujarat University, Ahmedabad 380 009; V. Ranganathan, Joint Secretary (R), Department of Atomic Energy, Bombay 400 039.

The office of the National Board for Higher Mathematics functions from the headquarters of the Department of Atomic Energy, Anushakti Bhavan, CSM Marg, Bombay 400 039.

The Board meets thrice a year, to discuss its programmes and various proposals received from Board members as well as from mathematicians all over the country. It has three subcommittees, viz. the Research Committee, The University Committee and The School Committee which consider proposals, usually for financial support for varied mathematical activities, from institutions and individuals.

## Research awards

Students possessing Master's degree in mathematics,

physics or statistics and wishing to take up research work in mathematical sciences leading to a PhD degree are eligible to apply for the NBHM Research Award. The selection of the Awardees is on the basis of academic records and on an interview by a selection committee constituted by the Board. Applications are invited through advertisements in leading national newspapers during March every year.

The Awardee is expected to do research work under an approved guide in an institution/university of his/her choice. The Awardee is entitled to leave facilities as per rules of the institution to which he/she is attached.

The award is tenable for one year in the first instance, and is extendable up to a period of four years subject to satisfactory progress which is assessed each year. The Research Award may be extended, if necessary, for the fifth year on the basis of a review of the Awardee by the Board.

The Awardee will have to register for a PhD degree for being eligible for the Award. However, in case the Awardee is required to undergo a pre-PhD training programme like M Phil before registering for PhD the Award may become operative from the date of enrolment for the pre-PhD programme. The Award will be given for the second year only if the Awardee has registered for PhD.

The amount of Research Award is at present Rs 2200 per month during the first two years. At the end of two years, the work done by the Research Awardee will be assessed by a Committee constituted by the Board. If the work is satisfactory the award may be enhanced to Rs 2500 p.m. In addition to the monthly stipend, a contingency grant of up to Rs 5000 per annum is also payable to the Awardee subject to production of bills supported by vouchers. The amount can be used for purchase of stationery and books, for library work and travel inside the country for attending conferences/lectures, etc. and towards payment for computer time. The books purchased by the Awardee from the contingency grant are allowed to be retained by the Awardee. A maximum amount of Rs 200 p.m. may be drawn from the contingency grant towards payment of hostel/house rent. The unutilized part of the contingency grant is allowed to be carried forward to the next year.

The Awardee will not be allowed to accept any appointment or receive any remuneration from any other source during the period of the Award. In case the Research Awardee is called upon to assist the institution in its teaching programme, the work-load should not exceed four hours of teaching at the post-

graduate level or six hours of teaching at the undergraduate level *per week*.

The Research Awardees are expected to acknowledge the support received from the Board in all their publications and in their Ph D theses.

### Post-doctoral fellowships

*The Scheme.* A few post-doctoral fellowships are awarded every year by the Board to promising young mathematicians to take up research work in various fields of mathematical sciences. Applications are invited through advertisements in leading national newspapers during March every year.

*Eligibility.* The post-doctoral fellowships are intended for mathematicians below the age of 40 who have a doctoral degree or equivalent published research work. Persons who have submitted their dissertations are also eligible to apply.

*Emoluments.* The post-doctoral fellowship carries a monthly stipend of Rs 3,500. The fellowship is initially given for two years, and can be extended by one more year subject to a review by the Board. In addition, the fellowship carries a contingency grant of up to Rs 6,000 per annum, payable on production of bills supported by vouchers. The contingency grant can be used for purchase of stationery and books, travel for attending conferences or other academic purposes such as consulting library. In addition, the contingency may be used to pay hostel rent. In case the Fellow is not staying in a hostel, an amount of up to Rs 250 p.m. may be drawn from the grant towards payment of house rent. Contingency grant not spent in a given year can be carried over to the next year. Books purchased from the contingency grant will be the property of the Fellow.

*Leave.* (a) A Fellow shall be entitled to all leave facilities as per the rules of the institution where he/she is working; (b) In special cases, and on recommendation of the head of the institution where employed, a Fellow can go on leave without stipend for a period not exceeding six months. The period of leave without stipend will count towards the tenure of the fellowship.

*Other conditions of the Award.* a) The fellowships are generally tenable at any university or institution where facilities exist for post-doctoral work; b) The Fellow will do full time research work in a subject chosen by him/her and approved by the institution concerned; c) A Fellow cannot accept any other employment or appointment, with or without pay, during tenure of the fellowship; d) A Fellow may assist in the teaching

programme of the institution where employed provided the teaching load does not exceed six hours per week; e) An annual report of the work done should be sent to the Board. It should include a list of publications of the Fellow during the year; f) It is understood that the institution where the Fellow proposes to work will provide the necessary infrastructural facilities and also agree to pay the fellowship stipend on monthly basis and keep an account of the contingency expenditure; g) The Fellows are expected to acknowledge receipt of financial support from the Board in their publications.

### Special Research Fellowships

These Fellowships are meant for persons who have exhibited considerable research and scholarly potential in their Ph D work and are working in frontier research areas.

Candidates for Special Research Fellowships may be proposed by a university or research institution with full bio-data, research work published and evaluation of the work done by experts in the field. The Board may also obtain independent evaluation of the academic work of the candidate.

Special Research Fellowships carry a stipend of Rs 4500 per month and a contingency grant of up to Rs 15,000 per annum. The Fellowship will be tenable initially for a period of three years. It can be continued for an additional period of two years after a review.

The Fellows will be expected to work at the proposing institution and will follow all the rules of the full time academic employee of the institution concerned.

The contingency can be used for purchase of stationery and books, travel for attending conferences or other academic purposes such as consulting library, visit to other institutions to consult colleagues, etc. In addition, contingency grant can be used to pay hostel rent, and, in case the candidate is not staying in a hostel, a house rent allowance of Rs 300 per month may be drawn from the contingency. Books purchased out of the contingency grant will remain the property of the Fellow.

The Fellows are expected to acknowledge the financial support received from the Board in all their publications.

### Teacher Fellowships

These are meant for college and university teachers who are working towards their Ph D and have already made some progress in that direction. These will be valid for a maximum period of three years. Persons under this Fellowship scheme will be entitled to receive a stipend equivalent to their total emolument (excluding special allowances if any) or Rs 4,000 p.m. whichever is less. It

is understood that such a person is not receiving a salary from any other source. In addition, they will be entitled to receive Rs 1000 per month as displacement allowance in case they will be working during the tenure of Fellowship at an institute or university located in a city different from their place of current employment.

Applications for such fellowships should state clearly the progress already made in the topic of research and should be supported by a letter from the thesis supervisor. The employing college or university should agree to grant leave to the candidate during the tenure of the fellowship. It is expected that the candidate will return to the parent institution at the end of the fellowship.

### **Short-term visits to institutions in India**

NBHM provides assistance to teachers to make short-term visits of at least six weeks duration to another institution in India for joint work etc. The assistance provided consists of full travel expenses and displacement allowance of Rs 2100 per month. Application for this must be accompanied with permission of the employing institution and that of institution/department to be visited, and must be made well in advance.

### **Travel assistance for young mathematicians**

NBHM provides partial or full travel assistance in deserving cases for attending conferences, symposia, summer schools, etc. inside the country or abroad. Applications are required to be made on prescribed forms at least *three months* before the date of the conference etc. International travel assistance is available only to persons *below 40 years* of age. The application form can be obtained from the office of the National Board.

### **Visiting Professors**

The Board provides funds for inviting mathematicians both from within India and abroad for lectures, joint work and other academic activities. Proposals for this may be submitted by mathematicians working in institutions of higher learning, and should be endorsed by the heads of the department and the institution. A foreign mathematician of eminence can be invited on the following terms: He should spend at least two months in India, of which at least one month should be at a single institution. He is expected to give a series of lectures in his field of interest and also visit other institutions. Proposals for such visitors should be sent at least one year before the date of visit. Once

approved, the visitor is paid round trip excursion fare from his country to India and a sum up to Rs 10,000 for travel within India. In addition, the person is eligible for a monthly honorarium ranging between Rs 6000 and Rs 8000. All arrangements related to the visit such as visa, RBI permission, etc. are to be made by the host institution. Proposals for inviting mathematicians from within the country are also considered by the Board. Such visits can also be organized over a period of years enabling a group to have the benefit of repeated interaction with a leading expert in the field.

### **Ramanujan Professorship**

The Board has instituted a Visiting Professorship in the name of Srinivasa Ramanujan effective from 1989. The Board, under the scheme, will invite an eminent mathematician to visit India for a period of at least two months and not more than four months. The visitor, under the scheme, is to be offered first class air fare from his place of residence to India and back. The Ramanujan Professor will be paid an honorarium of Rs 8000 per month during his/her stay in the country. In addition, an amount of up to Rs 10,000 will be paid by the Board for travel within the country. The Ramanujan Professor is expected to visit different mathematical centres in the country and deliver lectures even while he/she will be principally in residence at one institution in the country. The Professor will be provided accommodation wherever necessary at the expense of the Board.

### **Assistance for conferences**

The Board holds every year one or two instructional conferences in areas of mathematics of current interest. In addition, NBHM gives partial support for holding national and international conferences/workshops. The quantum of assistance depends on each proposal but does not exceed Rs 30,000 in the case of an international conference and Rs 20,000 in the case of a national conference. Applications for financial support should reach the Board at least three months before the start of the conference. Prescribed application forms may be obtained from the office of the Board.

### **Grant-in-aid for research schemes**

The Board has recently taken over the functions earlier entrusted to the Mathematics Committee of the Board of Research in Nuclear Sciences of the Department of Atomic Energy. The Board now sanctions grants for selected research projects on the recommendations of an advisory subcommittee constituted by the Board.

Applications in prescribed forms obtainable from the office of the Board have to be submitted well in advance.

### Support to libraries

The Board has envisaged a scheme to extend financial support to the libraries of various universities and institutions. The libraries of

- (a) Tata Institute of Fundamental Research, Bombay
- (b) Panjab University, Chandigarh
- (c) Indian Statistical Institute, Calcutta
- (d) Institute of Mathematical Sciences, Madras

have been identified by NBHM as 'Regional Libraries'. These regional libraries are expected to cater to the needs of the region in which they are located and are open to mathematicians of the region for consultation and interuniversity borrowing. Xeroxing facility should also be available at these libraries. It is planned to recognize a few more libraries in other regions of the country as regional libraries. The regional libraries, other than the ones attached to institutions funded by DAE, are given an annual library grant of Rs 4 lakhs.

In addition to the regional libraries, the mathematics departments of several universities receive grants of varying amounts of Rs 50,000 to Rs 200,000 from the Board on the recommendation of the advisory committee constituted by it. The departments desirous of receiving grants may apply to the Board on prescribed forms obtainable from the office of the NBHM.

The libraries receiving grants from the Board will be expected to extend their facilities to research workers of the neighbouring universities.

### Scholarships at Master's level

Attractive scholarships are awarded to a few outstanding students with a pronounced aptitude for research, studying for the Master's degree in mathematics or statistics in some selected institutions. The institutions are expected to mention these scholarships in their advertisements for admission to the Master's degree courses in mathematics/statistics. At present, the amount of scholarship is Rs 500. In addition, the scholars receive a book grant of up to Rs 2000 p.a. The scholarships are given for a maximum period of two years.

The scholarship awardees are selected by the respective institutions on the basis of suitably designed tests and interviews. The institutions are expected to monitor the progress of the students and communicate the recommendation to the Board for continuation of the scholarship for the second year.

### Scholarships for undergraduate studies in mathematics

As a first step towards supporting undergraduate studies in mathematics the Board awards *eight* scholarships to talented students wishing to pursue undergraduate studies leading to BSc (Honours) degree in mathematics at the Centre for Advanced Studies in Mathematics, Panjab University, Chandigarh. The value of each scholarship is Rs 700 p.m. It also carries a book allowance of Rs 1000 per annum. The maximum duration of the scholarship is three years.

Details of the selection procedure and other relevant information can be obtained from the Chairperson, Department of Mathematics, Panjab University, Chandigarh 160 014.

### Indian National Mathematical Olympiad (INMO)

*Aim.* The Indian National Mathematical Olympiad is an annual contest organized by the Board to spot and nurture mathematical talent among school students.

*Eligibility.* Normally, students of standard 11 of the 10+2 system or equivalent class alone are eligible to appear for this contest. A few exceptionally gifted junior students (of standards 9 and 10) also will be permitted to appear at the discretion of the Regional Coordinator.

*Syllabus.* There is no fixed syllabus for this examination. A sound knowledge of mathematics up to the 10th standard level will be adequate as background. However, the questions will not be of the routine type normally asked in school examinations. Clear understanding of the concepts and a high degree of resourcefulness in solving problems will be required, especially at the final stage of the contest.

Problems posed at these olympiads are regularly published in *Mathematics Education*, a journal published by the University Grants Commission, and in many journals of regional mathematical societies. Interested students may consult these journals for guidance.

### Regional and National Olympiads:

The Olympiad is conducted in two stages:

- i) *Regional Mathematical Olympiad (RMO)* conducted separately in different regions of the country sometime between October and December. A 'regional coordinator' is responsible for conducting the RMO in each region. All efforts are made to have at least one examination centre in each district of the region. Students are expected to appear for the examination at a centre of their choice at their own expense. A nominal fee is

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levied from each participant. Information about RMO in each region is sent by the Regional Coordinator to nearly every senior secondary school of the region and/or advertised in newspapers.

About 20–30 top scorers from each region are recommended by the regional coordinator for participation in the second stage of the contest.

ii) *The Indian National Mathematical Olympiad (INMO)* is conducted on the first Sunday of February. This is open only to the above RMO winners. Altogether about 300–400 students from all over the country appear for this examination. All the RMO winners of each region will be invited to appear for the INMO at one centre. These participants will be paid bus fare or second class train fare from their place of study to their regional centre and a suitable daily allowance for the day on which INMO is held.

The duration of INMO is 4 hours. The questions are likely to be considerably harder than at the Regional Olympiads. About 20–30 top scorers—‘INMO Awardees’—will be selected on the basis of their performance in INMO and informed of the result before 15 March.

*Scholarships.* The INMO awardees will be eligible for attractive scholarships during their studies beyond the 10+2 stage, provided they opt for mathematics as the main subject in their undergraduate (B Sc. etc.) course. The scholarship is at present Rs 700 p.m. The Awardees will, in addition, be given Rs 1000 p.a. as book grant.

*Training camps.* The INMO awardees will be invited to a training camp to be conducted during May–June. The duration of the training will be 3–4 weeks. The training camp is held under the overall supervision of the Convener of the School Committee of the NBHM. The present Convener is Prof. Phoolan Prasad, Department of Mathematics, Indian Institute of Science, Bangalore 560 012. The faculty for the training camp is drawn from all over the country.

The main aim of the camp is to impart intensive training to the students in solving problems and to select the Indian team for participation in the International Mathematical Olympiad (IMO). Lectures by eminent mathematicians are also arranged to introduce the students to several modern topics in mathematics.

*International Mathematical Olympiad (IMO).* Solely on the basis of continuous evaluation at this camp a team of at most six students will be selected to represent India in the IMO to be held in July of the same year.

The International Mathematical Olympiad is a prestigious contest held every year in a different country for students under 20 years who have not yet entered any university. India started participating in the Olympiad from 1989. In the maiden attempt (1989) four of the six Indian participants won bronze medals at the Olympiad held in Braunschweig, Germany. In the next (1990) Olympiad held in Beijing, India bagged one gold, one silver and two bronze medals. In the 1991 Olympiad held in Sigtuna, Sweden every member of the Indian team won a medal (three silver and three bronze medals). The Indian team was placed tenth among 56 participating countries.

The INMO is conducted under the overall supervision of a National Coordinator who is a member of the National Board for Higher Mathematics. The present National Coordinator is Prof. S. Izhar Husain, Department of Mathematics, Aligarh Muslim University, Aligarh 202 002.

Further details about INMO can be obtained from him, and about Regional Olympiads from the Regional Coordinators, whose names and addresses will be published in the July–September issue of the *Mathematics Newsletter* every year.

Any additional information may be obtained on request from the *Member Secretary, National Board for Higher Mathematics, Department of Atomic Energy, Anushakti Bhavan, CSM Marg, Bombay 400 039.*