

Indian Institute of Science Education and Research (IISER) and the Impact of its Establishment in Manipur

- 1. About IISER:** The Indian Institutes of Science Education and Research (IISERs) are a group of fairly young but premier institutes, established in India (firstly in 2006), that are focusing to uplift science education and its research study (more particularly) in the country in order to meet and exceed the current global standard. These institutions have been declared – as the institutions of national importance² – by Act of Parliament. The institutes were created by the Government of India – under the umbrella of the Ministry of Human Resource Development (MHRD), Government of India, India – under The National Institutes of Technology (Amendment) Bill, 2010 (an amendment of the National Institutes of Technology Act, 2007), which was passed by the Rajya Sabha on 30th April 2012^{3,4}. IISERs, since their establishments, are actively participating and play a key role not only in promoting high-quality science education and research in all parts of the country but also to social upliftment.
- 2. Vision and Objective:** The primary objective of establishment of IISERs is to provide high a quality education in Science – of global standard – to young minds (for global competition) and drive the scientific attitude in them¹⁸. It is (unlike the scenario of the conventional professional courses) not a mere of making people just to earn (or getting jobs) after its degree course of interest – including BSc, MSc, and BS-MS. Shortly, the goal of IISERs is to focus on science and produce promising scientists of international standard for the required entry to the global competition in research domain. In the other words, IISERs aim solely to drive young minds towards the global issues that are universal in nature (rather than that are localized). In the past, the country (India) had a privilege to own great scientists with a considerable number of them being conferred Nobel prizes (of the highest scientific recognition and reputation in the world) in recognition of their contribution (more specifically in academic, cultural, and scientific advances) and subsequently, to the well-being of mankind. In the present scenario of this country, bright and talented minds are mostly drained towards the professional courses – including administration, engineering, and medical – with the establishment of several premiere institutes of global reputation in the past few decades, say IITs, AIIMs, and IIMs. Science departments, although exist in such professional institutes, have a second-class status that results, in India, to degrading and falling behind its reputation of contribution in scientific advances that are not able to be supported solely by the existing universities (central, state, or private undertaking) across the country because of a certain physical condition of limited nature. With this clear and far-sighted vision, IISERs were established to revive the reputation of the country for their contribution to scientific advances. The government of India takes the needful steps aiming to establishing IISERs to create institutes of global reputation in Science – as IITs and AIIMs do in professional courses say engineering and medicine – and to expand the longstanding tradition of science education and its research study (of global standard) being contributed, more than a century, by premiere institute (more particularly, Indian Institute of Science (IISc), Bangalore locally known as Tata Institute being established (in 1908) by J R D Tata) followed by Tata Institute of Fundamental Research (TIFR), Mumbai and others. Everyone accepts that basic research in science is the backbone¹⁹ that later leads to developments in other aspects, including Medicine, Engineering and Technology, etc. Shortly, Engineering and Medicine are for today and Science is for tomorrow. So, unless talent also goes to science, the pipeline may become empty and it may result in a social imbalance that ends up to create an unstable system which collapses sooner than the expected lifetime.
- 3. Key Features:** In order to achieve the specific goal – being set by the Government of India – of establishing of science education and its research study in the country (India) of global standard and reputation so as to enable to play a pivotal role in the scientific development for welfare of mankind, Indian Institute of Science Education and Research (IISER) is entailed with a certain key features of global standard²⁰:
 - **Highly competent and motivated faculty** – who have gained, more or less, scientific expertise of education and research study around the globe – in various disciplines with a passion for science.
 - **Competent and promising students** – who have been admitted through national level screening test/examination.
 - **Ambient environment of like-mindedness of scientific advances** – where both faculties/guides/supervisors and admitted students are motivated and committed to a common cause of scientific advances (more particularly).
 - **Integrated undergraduate teaching with cutting edge research across disciplines**, i.e., the scientists (who are responsible for generation of knowledge and ideas through study and validation) are being

engaged in classrooms for teaching or transfer of their gained knowledge directly to the students. This is in contrast to the conventional approach in which the generated knowledge – say hypothesis, theory, and theorem, etc. being studied and validated through experiments by the scientific community – is transferred to the end users (students) through teachers (so called).

- **Library with online resources, books, and research journals** that facilitate to exchange knowledge without any boundary around the globe within no time. The system also facilitates a network of global knowledge exchange and sharing.
 - **State-of-the-art teaching (experimental) laboratory and/or classroom with necessary audio-visual teaching aids** that facilitates to build up an interactive classroom that is of global standard so as the students to be competent at any place (around the world).
 - **State-of-the-art research facilities with sophisticated instruments of requirement and of the highest standard** – for which the institutes are privileged and proud of – that are enabled due to not only because of the required funding but also expertise of the faculties.
 - **Maximal scientific exposure** – conducting seminar in contemporary topics and interaction with scientists (within or outside the country) of reputation as a day-to-day events that is of serious concern and one of the primary aspects of building scientific temperament and its growth.
 - **Exchange of students – for scientific queries – with other premiere institutes (within and/or outside the country).**
 - **Joint degree programme** in which IISERs initiate degree jointly conferred by IISERs and selective premiere institutes (abroad).
 - **Undertaking of research projects** – with state-of-the-art research facilities in the campus – by the students as a part of their degree courses, including BS_MS, Integrated PhD other than PhD.
 - **Summer/winter internship** – being open to the students from outside institutes – facilitates the opportunity to the students of other schools/colleges/institutions to enjoy the facilities of the institutes.
 - **High placement and employability – at high percentage – along with enrolment of the outgoing students to the premiere institutes (abroad) for further study.**
 - **Teaching Assistantship** – a key feature of the PhD Programme in which students take part in teaching assistant duties.
 - **Financial supports** – in the form of scholarship or fellowship – to students enrolled in the various programmes offered in this group of institutes. This financial support helps to relieve the students to bear the cost of his/her study.
 - **Post-doctoral research** that facilitates the candidates with PhD degree to undertake independent research.
 - **Sports and recreational facilities.**
 - **Hostel facility for all students and security of concern** that facilitates the institutes and students to conducts activities – both academic and non-academic – without any interruption and disturbance from outside the institutes.
 - **All-in-one facilities – including, medical, bank, and shopping complex, etc. – inside the campus.**
 - **Eco-friendly green campuses with appropriate infrastructure.**
 - **Undertaking of initiatives for mass education of science and research** – both by the students and faculties: (1) Outreach programme that reaches members – both faculties and students – of the institute to the remote areas, (2) Institutional Visit programme that invites and facilitates interested individuals/students to visit and explore the institutes, research laboratories, interact with the scientists. In the sense, the institute take social responsibility of mass education of science and its motivation.
 - **Adoption of under-privilege village(s) by the institutes taking the responsibility of social uplift of the village apart from the mass education of science and its research.**
4. **Courses and Eligibility:** There is, primarily, three degree courses of study offered in this group of institutes: (i) BS-MS, (ii) Integrated PhD, and (iii) PhD. IISERs admit only the competent and motivated students – in these various courses – through various national level competitive examinations²¹.

4.1. BS-MS Degree: It is a five year degree programme for bright and motivated students who have passed (10+2) level in Science stream. The programme integrates teaching and learning of Science (in the one hand) and research (on the other hand) that provides an ample scope/platform of learning the multidisciplinary aspects of scientific queries. The first two years of the programme consist of core courses in basic sciences, the third and fourth years are dedicated to specialization in chosen science subjects of interest, and the fifth year includes a research project. The training during the programme enables students to pursue a career in academia, R&D institutes, and science-based industries²⁰.

The enrolment of the students, in this degree course to the institutes (IISERs), is competitive in nature with proper screening of knowledge and motivation of the students to further pursuance in science as a career of interest through various channels of national level competitive examinations. There are, primarily, three channels of admission in this group of institutes, i.e., candidates are admitted to IISERs only through these channels:

- a. **Kishore Vaigyanik Protsahan Yojana (KVPY) channel** through which candidates having a valid KVPY fellowship commencing from the ongoing academic session are eligible to apply for admissions. KVPY is an on-going National Programme of Fellowship in Basic Sciences, initiated and funded by the Department of Science and Technology, Government of India while it is organized by the premiere institute of the country (Indian Institute of Science (IISc), Bangalore, India), to attract exceptionally and highly motivated students for pursuing basic science and research in science as a career. The objective of the programme is to identify students with talent and aptitude for research; help them realize their academic potential; encourage them to take up research careers in Science, and ensure the growth of the best scientific minds for research and development in the country. For more detail to KVPY, one may visit (<http://kvpv.iisc.ernet.in/main/index.htm>).
- b. **Joint Entrance Examination of Indian Institutes of Technology (IIT-JEE) channel** through which candidates in General category securing a specified rank within (10000 for 2017 session) in the Common Rank List (CRL) of JEE Advanced (2017) are eligible to apply. For candidates belonging to reserved category (OBCNC, SC, ST, PD), their category rank should be within the specified rank (10000 for 2017 session). For more detail to IIT-JEE, one may visit²².
- c. **State and Central Boards Channel (SCB) channel** through which students who have passed (10+2) level with science stream in the ongoing or immediate past year (say, 2016 or 2017 for the 2017 session) with marks equal or above the cut-off percentage (top 1%) in their respective boards (Table 1 gives cut-off marks of various boards for 2017-session) are eligible to apply. Students applying through SCB channel are required to appear in the IISER Aptitude Test which are conducted at the various centres across the country. For more detail to SCB channel, one may refer²¹.

Table 1: Cut-off mark for various boards – for admission of BS-MS degree in IISERs – in the country.

Name of Board	Cut-off percentage*	Name of Board	Cut-off percentage*
AMU Board	81.4	Andhra Pradesh	95.4
Assam	74.5	Bihar	71.0
CBSE	90.0	CISCE (ISC)	92.9
Chattisgarh	76.6	Goa	83.3
Gujarat	65.9	Haryana	86.3
Himachal Pradesh	79.7	Jammu Kashmir	84.4
Jharkhand	61.0	Karnataka	87.5
Kerala	93.3	Madhya Pradesh	82.0
Maharashtra	77.9	Manipur	77.6
Meghalaya	68.3	Mizoram	67.4
Nagaland	66.5	Orissa	71.6
Punjab	80.7	Rajasthan	78.7
Tamil Nadu	95.2	Telangana	97.3
Tripura	68.2	Uttar Pradesh	74.2
Uttarakhand	67.9	West Bengal	78.9
Visva-Bharati	83.1	NIOS	83.6

The merit list is prepared separately for candidates who had applied through Joint Entrance Exam, (JEE), Kishore Vaigyanik Protsahan Yojana (KVPY). There is a separate IISER merit list for candidates who are taking the IISER Aptitude Test. IISER will award 50% of the available seats on the basis of the ranks secured by candidates in the merit list of IISER based on JEE Advanced and KVPY result. The other merit list for the remaining 50% of the seats for IISER Admission is prepared on the basis of IISER Aptitude Test¹⁷.

4.2. Integrated PhD Degree: Integrated PhD Programme is a research programme. At the end of the successful completion, Master of Science and Ph.D. degree are awarded.

The first three semesters consists of core and elective courses specialized in one subject (Biology, Chemistry, Mathematics or Physics) while the fourth semester consists of advanced courses and research project. After the successful completion of comprehensive and project work, the student will continue with research leading to the Ph.D. degree. This integrated PhD course is known - in the country - for its high quality of education and research. The eligibility criteria for this course draws as:

- a. A Bachelor's degree in Biological Sciences/Chemical Sciences/Mathematical Sciences/Physical Sciences/Engineering/Technology and related areas as applicable to individual Schools, under the 10+2+3/4 system.
- b. Candidates admitted to certain schools or departments are required to have a valid score in Joint Entrance Screening Test (JEST). JEST is a joint entrance test for applicants seeking admission for a PhD/Integrated PhD degree in Physics or Theoretical Computer Science or Neuroscience or Computational Biology in one of the Participating Institutes may appear for the Joint Entrance Screening Test (JEST) at one of the Exam Centers. The Science & Engineering Research Board (SERB) (statutory body established through an Act of Parliament), DST, Govt. of India, India recognizes JEST as a National Eligibility Test (NET) in their office Memo vide OM No.SB/S9/Z-01/2015. Fellows working in SERB programme and qualified in NET are eligible to get enhanced fellowship (<https://www.jest.org.in/>).
- c. The minimum requirement for admission to the programme is 55% marks or 6.0 out of 10 CGPA in the Bachelor's degree (as declared by the University).

Selection procedure undergoes, firstly, with short-listing of candidates followed by a written test (as followed in some of the schools of the group of institutes). Then, the short-listed candidates in the written test are invited to appear for interview(s). In certain schools or departments, candidates with a valid JEST (Joint Entrance Screening Test) scorecard are shortlisted and called for the interview²¹.

4.3. PhD Degree: The PhD programme at IISERs is a blend of class room curriculum and mentoring undergraduate students along with a major research component. This group of institutes admits students to doctoral programme in various areas of research including Biology, Chemistry, Earth and Climate Sciences, Mathematics, Physics, Humanities & Social Sciences, Biomedical and other inter-disciplinary areas.

Students - who apply to our PhD programme - need to obtain Master's degree in Science or a four-year Bachelor degree with at least 60% marks (or equivalent) in the Qualifying Degree (Master's degree or equivalent). In addition to the qualifying degree, the students are required to have qualified a national level examination such as CSIR-UGC NET/GATE/JEST/NBHM/JGEEBILS/INSPIRE PhD, etc. depending on their area of research of interest as well as the institute(s) of choice. Students are selected for enrolling to the PhD programme based on performance in the interviews.

5. **Scholarship:** For the BS-MS degree, KVPY scholars admitted to IISERs would draw fellowship as per KVPY norms (<http://kvpvy.iisc.ernet.in/main/fellowship.htm>). For SA/SX/SB candidate - during 1st to 3rd years of B.Sc./B.S./B.Stat./B.Math. /Integrated M.Sc./M.S., an amount of Rs 5,000.00 (exclusive of annual contingency grant of Rs 20,000.00) is awarded against monthly fellowship while for SA/SX/SB - during M. Sc./ 4th to 5th years of Integrated M.Sc./M.S./M.Math./M.Stat. - the monthly fellowship is Rs 7,000.00 with an additional annual contingency grant of Rs 28,000.00. In addition, a limited number of INSPIRE scholarships is available for candidates admitted through JEE Advanced and SCB channel as applicable as per the norms prescribed by DST INSPIRE scheme. INSPIRE is an innovative programme or initiative developed by the Department of Science and Technology (DST), Govt. of India, India to attract talented young minds to the excitement and study of science at an early stage, and to help the country to build the required critical resource pool for strengthening and expanding the science and technology system, and R&D base with a long term foresight. Under the INSPIRE programme, Scholarship for Higher Education (SHE) aims at attracting talented young minds into undertaking higher education in science intensive programme, by facilitating scholarship with an amount of Rs 0.80 lakh per annum to the students - in the age group of 17-22 years - for undertaking Bachelor and Master degree in Natural and Basic Sciences (<http://www.inspire-dst.gov.in/AORC.html>).

For Integrated PhD degree, the students will be awarded Institute scholarship of Rs 10,000/- per month until the successful completion of the coursework and comprehensive examination provided the student maintains a minimum AGPA (annual grade point average) of 6.0. After clearing the comprehensive examination, the studentship will be made equivalent to that of UGC-CSIR JRF/SRF excluding the contingency grant and HRA (House Rent Allowance) which is dependent on the cities of the host institutes.

For PhD degree, the monthly fellowship awarded to the PhD scholars is at par with the CSIR-UGC Junior Research Fellowship (JRF) and Senior Research Fellowship (SRF). For JRF, in the first two years of the research programme, the emoluments per month is Rs 25,000.00. After successful completion of two years as JRF, the candidates are qualified for SRF with an increase of emolument to Rs 28,000.00 for the next three (3) more years.



Fig. 1: Geographical location of the seven (7) existing IISERs that are offering admission in various degree courses – namely, BS-MS, Integrated PhD, and regular PhD – in India. Marked spot (in green color) indicates the existing while red mark spot represents the IISER that was announced in budget 2015 (but not yet commencing).

Table 1: Detail of the seven (7) existing IISERs.

Sl. No.	Name	Short Name	Year of Establish	City/Town	State/UT	Website
1.	IISER Kolkata	IISER Kolkata	2006	Kalyani	West Bengal	www.iiserkol.ac.in
2.	IISER Pune	IISER-P	2006	Pune	Maharashtra	www.iiserpune.ac.in
3.	IISER Mohali	IISER-M	2007	Mohali	Punjab	www.iisermohali.ac.in
4.	IISER Bhopal	IISER-B	2008	Bhopal	Madhya Pradesh	www.iiserb.ac.in
5.	IISER Thiruvananthapuram	IISER-TVM	2008	Thiruvananthapuram	Kerala	www.iisertvm.ac.in
6.	IISER Tirupati	IISER-T	2015	Tirupati	Andhra Pradesh	www.iisertirupati.ac.in
7.	IISER Berhampur	IISER-BPR	2016	Berhampur	Odisha	www.iiserbpr.ac.in
8.	IISER Nagaland	NA	Not yet commenced (though announce two years back)	NA	Nagaland	NA

5. Existing IISERs: Till date seven IISERs have been established across the country – namely IISER Kolkata in West Bengal, IISER Pune in Maharashtra, IISER Mohali in Punjab, IISER Bhopal in Madhya Pradesh, IISER Thiruvananthapuram in Kerala, IISER Tirupati in Andhra Pradesh and IISER Berhampur in Odisha^{5,6} – to distribute over the different geographical regions of the country. Figure 1 depicts the geographical distribution of the seven (7) IISERs already existed across the country. Another IISER was also announced – for establishment in Nagaland (as shown with red spot in Figure 1) so as to facilitate the uniform geographical distribution of the institutes across the country and to reach the innovative national undertaking of teaching and learning of scientific advances to the masses of far east of the country – in the 2015-Budget^{7,8}. Unfortunately, the announced institute is not reported for commencing its function till date (even after two years of announcement). **It seems that the Nagaland government would prefer a different institute (SPA - School of Planning and Architecture) instead of an IISER¹⁰.** It

is clearly observed – in the absence of IISER in Nagaland (red spot in Figure 1) – the geographical distribution of IISERs across the country is uneven and biased that may lead lagging behind not only the science education and scientific advances to general masses of North-east states of India but also social upliftment and development.

The financial outlay for each IISER is around ₹5 billion (US\$78 million) for the first five years. Table 1 provides the detail of the seven existing IISERs.

6. **Functioning of IISERs:** All the IISERs are autonomous institute and are independent of each other in administration including non-transferability of the faculties/staffs/students. All of the IISERs – before completion of construction and moving to their respective permanent campuses – start operation or functioning from an specified campus temporarily, commonly known as the transit campus. IISER-Kolkata was functioning – before moving to the permanent campus – from the temporary campus at Mohanpur within the campus of Bidhan Chandra Krishi Viswavidyalaya¹¹. IISER-Pune started functioning from the National Chemical Laboratory Pune campus before it moved to the permanent campus. Similarly, IISER-Mohali started functioning from the Mahatma Gandhi State Institute of Public Administration complex in Sector 26 Chandigarh. Now, IISER-Mohali is fully functioning on its permanent campus at Mohali. IISER-Bhopal started functioning from the ITI Gas Rahat Building Govindpura Bhopal. The Institute shifted to its Bhauri-main campus in 2012¹². IISER-Thiruvananthapuram started functioning from the College of Engineering, Trivandrum and now, it starts shifting to its permanent at Vithura. IISER Berhampur, Odisha commenced in 2016¹³ functioning from a transit campus.

Table 2: Number of seats – for BS-MS degree – at each IISERs.

Sl. No.	Location of IISER	Number of Seats
1.	Berhampur	100
2.	Bhopal	260
3.	Kolkata	200
4.	Mohali	200
5.	Pune	200
6.	Thiruvananthapuram	200
7.	Tirupati	125

7. **Seat Intake at IISERs for 2017:** In the year 2017, the total number of seats for admission – to BS-MS degree – at different institutes of IISER is 1285. The number of seats at each institute of IISER is given below in the table.
8. **Career Options and Opportunity:** IISERs – since its establishment in the last 10 years or so – are privilege and proud to offer the best training to the young minds of the country in basic sciences and unparalleled exposure to advanced scientific techniques. Even though, these institutes are relatively new, it is successful to create an awareness to the general public (both national and international) about their existence and quality education. In the view of general belief that the viable career options for IISER graduates are limited, the underlying fact is that the education and training facilitated during the various IISER programmes equip students to pursue a career in academia, R&D institutes, and science-based industries. In the sense, IISERs are focusing to provide a platform for the students who are motivated and interested in the career to the queries of scientific advances while not enabling students to ‘just earn’ after its BS-MS course. With the Science departments in IITs being overshadowed by their Engineering counterparts, the primary focus of education and research training on the Sciences at the IISERs was a conscious decision – of Government of India – to specifically promote research in the respective fields of basic sciences and their interdisciplinary aspects, in order to meet and exceed the standards of the current global scenario.

To be fair, the career opportunities for IISER graduates are - more or less - attuned to research in scientific advances. Having said this, there is nothing that stops the students from opting for a career in other professions – including medicine and engineer – after completing a BS-MS from an IISER system of education. The annual placements at IISER attract recruiters from various multinational companies (MNC)²³ such as Ranbaxy, Unilever, GE Healthcare, Dr. Reddy’s, Shell, L’Oreal, Glenmark, etc. The career options for IISER graduates can be enlisted as²³:

- **Further research study in the institution of global reputation (abroad or within the country):** A good number of the students, who are graduated with BS-MS degree, opt to go abroad to pursue a Doctorate and a post-doctorate (for PhD degree candidates). For them, life is open as far as jobs are concerned.
- **Academia (Research):** After doing a PhD, post BS-MS course, one can join – as a staff scientist or principal investigator – various national research organization including ISRO, DRDO, CSIR labs or University or research laboratories.
- **Academia (Teaching):** The IISER graduates can take up a teaching job in any school/University after qualifying the requisite exams like UPSC, B. Ed, NET, etc.
- **Industry (Research & Development):** Doing a PhD after your BS-MS course will open the doors of any company for the students to join as a scientist in their R&D department for which various programs for interacting with industries are initiated in the institutes.

- **Industry (Sales/Management):** After completing PhD, one can pursue MBA or a business-related course and join the sales or marketing team of any reputed organization.
- **Scientific Writing:** One can explore opportunities in scientific journals like Cell, Science, Nature, etc. as an editor.
- **Teaching:** After completing BS-MS, one can teach at coaching classes for national level competitive examination.
- **Legal Advisor:** After your BS-MS, one can work as a legal advisor or administrator in biotech companies or Universities.
- **Patent Officer/Grant Writer:** For a patent officer, one need to take up a law course on patent filings, etc.
- **Be your own boss:** If one can invest a little then you can start your own coaching classes or a consultancy.
- **Government Services:** One can apply for different positions in various ministries as they recognize MS degree given by IISERs.

The institutions themselves take in only the most capable and competent students, as is quite apparent when one of the criteria for gaining admission here is being in the top 1% in the board exams.

Shortly to say, job opportunities for the IISER graduates are plentiful in both the public as well as the private sectors, and arguably the best career choice would be in R&D. But this would involve a great amount of dedication and a passion for research.

IISER is one of the best institutions to pursue one's education, provided your aim is not to simply get a standard run-of-the-mill job and settle down into a hamster-on-a-wheel routine. The country is empowering its students by providing state-of-the-art facilities and top-notch faculties. It would be a shame to make use of such resources and not add to the scientific wealth of mankind and the nation.

9. **Present Status of Scientific Temperament in Manipur and its Possible Change with Establishment of IISER in the State:** One witnesses a wind of changes in North-eastern states (in general) and Manipur (in particular) since last one decade or less. These changes include development in socio-economic, infrastructure, law and order, peace and harmony of co-existence, healthcare, education, science and technology, and entrepreneurship in business, etc. Shortly, one may say the quality of one's life is greatly improved. Specifically, focusing to the education and its system, several national level institutes or universities – namely National Institute of Technology (NIT), Indian Institute of Information Technology (IIIT), Manipur Technical University (MTU), Indira Gandhi National Tribal University (IGNTU), Institute of Bio-resources & Sustainable Development (IBSD) – were established in the recent past few years while National Sports University is already agreed for establishment. The establishment of these national institutes or universities give a significant impact in change and uplift not only education – both from the quality and quantity aspects – and its system (in particular) but also social life of the state (Manipur). This may be because of the integral nature of the national institutes that combines quality, competition, and transparency. This is in addition to the longstanding contribution accomplished from a consistent effort of the existing institutes or universities (under state or central government undertaking), say, Manipur University (MU) in education (and partly in research), Manipur Institute of Technology (MIT) and Industrial and Training Institute (ITI) in technology, Central Agricultural University (CAU) in agricultural education and research, and Regional Institute of Medical Science (RIMS) and Jawaharlal Nehru Institute of Medical Science) in medicine, etc. All of these institutes (state or central) focus either to professional courses or traditional education for a degree (with an exception of CAU). It is notable that the temperament of Science and scientific advances in North-east states (in general) and Manipur (in particular) are much lagging behind – both in quality and quantity aspects – the mainstream of national and international standard. On the other hand, it is known to all the potential and hidden talent or skills of individual/student (in North-east) to Physical Sciences – including Mathematics and Physics – at his/her early stage. However, a majority of these potential and promising individuals are drained to other professions while only a handful of individuals retain and pursue Science as a career at the end. Even, the higher percentage of this group of Scientists – who gained an advanced research training and expertise from premiere institutes of reputation in Science (within India, including Indian Institute of Science (IISc) and Tata Institute of Fundamental Research (TIFR), and abroad) and undertake Science with passion – opt to pursue their scientific research not in their place of birth (but in competent institutes in other parts of the country or abroad). The primary reason for this kind of brain drain may be due to lack of establishment of competent and promising institutes – that focus on Science and scientific advances –, and/or lack of scientific temperament in this region of the country.

Establishment of Indian Institute of Science Education and Research (IISER) in Manipur will address the majority of the concerns – with the inherent and unique features of IISERs – and greatly benefits the region that can be underscored as:

- **Uplift the temperament of Science and scientific advances of the global standard** not only in the state but also in the entire region of North-east state.
- **Building up and maintaining a competitive environment among the masses – including students** – that will be enabled along with the arrival of: (1) the competent and promising students being admitted through national level competitive examination. The institutions themselves take in only the most capable and competent students, as is quite apparent when one of the criteria for gaining admission is being in the top 1% in the board exams. (2) the highly competent and motivated faculty – who have gained scientific expertise of education and research study of international standard – in various disciplines with a passion for science.
- **Advancement in science and technology** that will provide an ample opportunity for overall development in the region along with the look-east policy.
- **Attractive point for our own competent diaspora** – who are experts of international standard in their own field of research study – working far away (within or outside the country) from birth place in search of finding a promising platform for conducting the research study of global standard. This establishment will facilitate an opportunity to the competent and promising diaspora fulfilling their longstanding desire of serving and contributing to their own place of birth. In turn, the region will be greatly benefitted of this kind of service to their own place with maximal outputs.
- **Building and nurturing of individuals/students with a passion in Science to the career of his/her choice in scientific research for maximum outputs.**
- **Mass awareness of science and scientific advances.**
- **Influence in the existing education system for the required change to the global standard.**
- **Higher education centre or hub for East Asian Countries.**
- **Development of under-privilege village through the adoption program of IISERs.**
- **Protection of outgoing financial expenditure (for higher education) to other places** in which because of the prevailing situation in the state (Manipur) – including law and order, and higher education system – not less than 40% of state economy outflows for seeking higher education in places other than to his/her own place.
- **Job creation at various levels including supporting staffs to the institute.**
- **Creation of platform for starting entrepreneurship** that can be achieved through the undertaking of incubation centre open in all the IISERs.
- **Employment of the youths (of the region):** (1) students, who got admitted to the institute, are placed for higher study in the premiere institute (within and outside the country) or opt for job opportunities (as mentioned in the **Section: Career Options and Opportunity**). (2) Job opportunities will be increased many-fold with the establishment of technology-based entrepreneurs or business settings.



Fig. 2: Geographical distribution of twenty-three (23) IITs in India. The figure is adopted from Ref. 25.

- Socio-economic development along with the advancement in Science and scientific research, and technology.



Fig. 3: Geographical distribution of twenty (20) IIMs in India.
The figure is adopted from Ref. 25.



Fig. 4: Geographical distribution of seventeen (17) AIIMSs in India.
The figure is adopted from Ref. 28.

The establishment of IISER in Manipur will greatly benefit the masses of the region not only from the aspects of academic but also from a social impact. This social impacts includes – in addition to the uplift of one's quality of life – circumvent of a possible outcome of social imbalance that may arise due to the undue biasing in the distribution of one's choice in profession, and subsequently, to prevent the possible social instability which is a root cause of chaos in a system and hindrance to development.

10. Feasibility of Establishment of IISER in Manipur: The development – in all fronts (in general) and academic (in specific) – in the entire region of North-eastern States of the country (India) is comparatively far lagging behind and this is known to one and all. Even though one may observe a certain change (in the recent past) with an special attention, the pace at which it is moving remains still questionable in order to meet and overtake the current (national and/or global) standard of scientific advances. It means to say that, from technology aspects, a limited number of premiere institutes of national importance – including one (1) Indian Institute of technology (IIT) in Guwahati and one (1) Indian Institute of Management (IIM) in Shillong – were established for the entire eight (8) states of the North-east India while twenty three (23) IITs^{24,25} were already established distributing over entire region of the country, which gives more or less one (1) to each existing state of the country with the exception that there is one and only one IIT for the entire seven (7) states (see Figure). In the meantime, there are twenty (20) IIMs being established in the country, i.e., nineteen (19) IIMs^{26,27} are distributed over the twenty two (22) states of India that gives a uniform geographical distribution of one IIM in one state with the exception that one and only one IIM is shared to the entire region of eight states of North-east India. Again, seventeen (17) All India Institute of Medical Science (AIIMS)²⁸ – that includes seven (7) newly announced (not yet functioning) – are established in the country at which there is no share of the institute for the entire region of North-east India while it reach to almost one institute in one state. In addition, there is a considerable number of states – apart from the metropolitan cities – which have the privilege of housing multiple

institutes of national importance. Example, Orissa is proud of establishing AIIMS, IIT, IISER, National Institute Science Education and Research (NISER), etc. With the facts, seeking the establishment of institutes of national importance in the North-east India is of fundamental requirement. Being already established at

least one institute of national importance to Meghalaya (IIM) and Assam (IIT), it is institutive to establish an upcoming institute of national importance in Manipur. The establishment of IISER in Manipur is supported by the fact that it is only Manipur – among the other states of North-east India – that competes with Assam in Science and/or other – both in quality and quantity. There is a considerable number of promising (Manipuri) scientists who have gained the required expertise of training and education in Science of the global standard, and still pursuing the career of his/her choice in Science with passion in the premiere institute of India or abroad (A separate sheet is attached as an Annexure). A consideration number of Manipuri faculties are working in the existing IISERs – Dr. Chandrakanta S Aribam, Department of Mathematical Science, Indian Institute of Science Education and Research Mohali (IISER-Mohali), Mohali; Dr. Mayanglambam Suheshkumar Singh, School of Physics (SoP), Indian Institute of Science Education and Research Thiruvananthapuram (IISER-TVM), Thiruvananthapura, Kerala; Dr. Nongmaithem Sadananda Singh, School of Biology (SoB), Indian Institute of Science Education and Research Thiruvananthapuram (IISER-TVM), Thiruvananthapura, Kerala – that would be of significant help while establishing IISER in Manipur. Manipur possesses the required potential of grooming and growing science. Not less to mention, the hidden potential of Manipuris (in particular) in Physical Science is recognized and accepted by one and all. It is worth to underscore that one (1) IISER was already announced – for establishment in Nagaland so as to facilitate the uniform geographical distribution of the institutes across the country and to reach the innovative national undertaking of teaching and learning of scientific advances to the masses of far east of the country – in the 2015-Budget^{7,8}. However, there is no report of commencing its function till date (even after two years of announcement). **It seems that the Nagaland government would prefer a different institute (SPA - School of Planning and Architecture) instead of an IISER¹⁰.**

11. **Conclusion:** The development in the entire region – more specifically in Science – of all the eight (8) states in North-east India is comparatively lagging behind even though there is hidden potential to grow. The pace, at which the ongoing development is moving, remains still questionable in order to meet and overtake the current (national and/or global) standard of scientific advances. With the key features of IISER group of institutes, the establishment of IISER in this region will be certainly of significant contribution not only to accelerate the pace of development in Science and scientific temperament (in specific) and education (in general) which will subsequently give a social impact. In the meantime, amidst the wind of change of establishing a considerable of premiere institutes – focusing to research study in Science and scientific advances – across the country, the pursuance of establishment of premiere research institute of national importance in this region is validated and becomes a call of the day. From the aspect of the other two existing premiere institutes – one in Assam and one in Meghalaya –, preferring of Nagaland Government institute of planning and architecture to the IISER (that was already sanctioned for establishment few years back in Nagaland) and the promising factor of growing the establishing premiere institute, Manipur is a potential and promising place to host. Lastly, establishment of IISER in Manipur will greatly benefit the place not only from the aspects of education (in general) and Science (in particular) but also the socio-economy and other vital facets of a society. It is a boon, in true sense.

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Annexure:

1. List of Manipuri faculties/researchers working outside the country:
 - Prof. Lalit Pukhrambam, School of Medicine, Associate Professor, Wayne State University, USA (<http://anatomy.med.wayne.edu/profile/ak1157>)
 - Prof. Ruhikant A. Meetei, Associate Professor, Department of Experimental Hematology and Cancer Biology, Cincinnati Children's Hospital, USA (<https://www.cincinnatichildrens.org/bio/m/ruhikanta-meetei>)
 - Dr. Surjalal Sharma, Principal Research Scientist, Department of Astronomy, University of Maryland, USA (<https://www.astro.umd.edu/~ssh/index.html>),
 - Dr. Thokchom Birendra Singh, Division of Material Science and Engineering, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Johannes Kepler University, Austria (https://www.researchgate.net/profile/Thokchom_Singh),
 - Dr. Jogendra Kshetrimayum, Lecturer, Department of Sociology, Anthropology and Criminology, Eastern Michigan University, USA (<https://www.coursicle.com/emich/professors/Jogendra+Kshetrimayum/>)
 - Dr. Nongmaithem Jiten Singh, Principal Scientist, Samsung SDI, South Korea (https://www.researchgate.net/profile/Jiten_Nongmaithem)
 - Dr. Oinam Nganba Meetei, Research Scientist at Amazon, Greater New York City Area, USA (<https://www.linkedin.com/in/oinam-nganba-meetei/>),
 - Dr. Archana Anandakrishnan (married to Oinam Nganba Meetei), Data Scientist/Machine Learning Researcher at American Express, New York, USA (<https://www.linkedin.com/in/archanaanandakrishnan/>)
 - Dr. Joykumar Thokchom, Director Solid Battery Products, Great Wall Motor Co. Ltd., Baoding (Near Beijing), China (<https://www.linkedin.com/in/joykumar-thokchom-ph-d-09566983/>)
2. List of Manipuri faculties working in institutes of national importance of the country:
 - Prof. Upendro Nongthomba, Department of Molecular Reproduction, Development and Genetics (MRDG), Indian Institute of Science (IISc), Bangalore (<http://www.mrdg.iisc.ernet.in/upendra-nongthomba/>)

- Dr. Kshetrimayum Jugeshwar Singh, Co-ordinator Physics/Senior Researcher, Talent Development Centre (TDC), Indian Institute of Science (IISc), Bangalore (<http://tdc.iisc.ernet.in/contact.html>)
 - Dr. Chandrakanta S Aribam, Department of Mathematical Science, Indian Institute of Science Education and Research Mohali (IISER-Mohali), Mohali (<http://www.iisermohali.ac.in/faculty/dms/dr-chandrakant-s-aribam>)
 - Dr. Mayanglambam Suheshkumar Singh, School of Physics (SoP), Indian Institute of Science Education and Research Thiruvananthapuram (IISER-TVM), Thiruvananthapuram, Kerala (<http://www.iisertvm.ac.in/faculties/suhesh.kumar.php>)
 - Dr. Nongmaithem Sadananda Singh, School of Biology (SoB), Indian Institute of Science Education and Research Thiruvananthapuram (IISER-TVM), Thiruvananthapuram, Kerala (<http://www.iisertvm.ac.in/faculties/nssingh.php>)
 - Prof. Shanta Laishram, Associate Professor, Indian Statistical Institute (ISI), New Delhi (<https://www.isid.ac.in/~shanta/>)
 - Dr. Chingangbam Pravabati Devi, Associate Professor, Indian Institute of Astrophysics (IIA), Bangalore (https://www.iap.res.in/people/personnel_faculty.htm)
 - Prof. Nongmaithem Rakesh Singh (Professor, Department of Electronics and Electrical Engineering (EEE), Indian Institute of Technology (IIT), Guwahati, Assam (http://www.iitg.ac.in/engfac/krs/public_html/))
 - Dr. Rakesh Singh Moirangthem, Assistant Professor, Department of Applied Physics, IIT (ISM)-Dhanabad, Jharkhand (https://www.iitism.ac.in/index.php/Faculty_members/profile)
 - Dr. Sanasam Ranbhair Singh, Associate Professor, Department of Computer Science and Engineering (CSE), Indian Institute of Technology (IIT), Guwahati, Assam (<http://www.iitg.ernet.in/ranbir/>)
 - Dr. Vareishang Tangpu, Assistant Professor, Regional Institute of Education, Mysore (<https://www.iesrj.com/upload/28-Vareishang%20Tangpu.pdf>)
 - Dr. K Sarjit Singh, Scientist, National Institute of Oceanography, Goa (http://www.nio.org/index/option/com_researcherdisplay/task/show/tid/2/sid/69/rid/1199)
 - Dr. Laishram Rakesh Singh (Wellcome Trust Fellow (intermediate)), Scientist E1, Rajiv Gandhi Centre for Biotechnology (RGCB), Thiruvananthapuram, Kerala (<https://www.rgcb.res.in/rakesh-s-laishram.php>)
 - Dr. Oinam Gunadhor Singh, Associate Professor, Physical Research Laboratory (PRL), Ahmedabad
3. List of Manipuri researchers working in various organizations of national importance of the country:
- Dr. Naorem Giridhar Singh, Scientist-F, Defense Research and Development Organization (DRDO), Pune (<https://www.facebook.com/giridhar.naorem>)
 - Mrs M Memita Devi, Scientist-D, Defense Research and Development Organization (DRDO), New Delhi
 - Mrs Kiran Devi, Scientist-D, Defense Research and Development Organization (DRDO), New Delhi
 - Raghu Nithoujam, Scientist-E, Indian Space Research Organization (ISRO) Satellite Center, Bangalore (<https://www.facebook.com/raghu.ningthoujam>)
 - Rashmi Behera (married to Raghu Ningthoujam) Scientist-E, Indian Space Research Organization (ISRO) Satellite Center, Bangalore (<https://www.facebook.com/rashmi.behera.73?pnref=friends.search>)
 - Indian Council Medical Research (ICMR) ()
 - Dr. Ngaseppam Iboyaima Singh, Head, Fruit and Vegetable Technology, Central Food Technological Research Institute (CFTRI), Council of Scientific and Industrial Research (CSIR), Mysore
 - Mrs. Crassina Kasar, Scientist, Flour, Milling, Baking, and Commonfactory Technology, Central Food Technological Research Institute (CFTRI), Council of Scientific and Industrial Research (CSIR), Mysore
 - Thinganglong Longvah, Scientist-G, National Institute of Nutrition (<http://ninindia.org/scientistnames.html#>)
 - Dr. Dilip Angom, Theoretical Physics Division, Physical Research Laboratory (PRL), Ahmedabad, Gujarat (https://www.researchgate.net/profile/Dilip_Angom)
 - Dr. Raghumani S Ningthoujam, Scientist, Chemical Division, Bhabha Atomic Research Centre (BARC), Mumbai
 - Dr. Laishram Guneshwor Singh, Scientist-F, Bhabha Atomic Research Centre (BARC), Mumbai
 - Dr. Haorongbam Bisheshwar Singh, Associate Professor, PES University, Bangalore, Karnataka
4. List of Manipuri researchers working as postdoctoral fellow outside the country:
- Dr. Thangjam Guneshwar, Postdoctoral Fellow, Max Planck Institute for Solar System Research, Germany (<https://www.mps.mpg.de/staff/19850>) (NOTE: International Astronomical Union (IAU) named an asteroid ("Thangjam Asteroid" or "11806 Thangjam") after this young scientist in recognition of his unique research contribution to Astronomy and Astrophysics²⁹)
 - Dr. Raju Laishram, Postdoctoral Fellow, Imperial College London, United Kingdom (UK)
 - Dr. Johnson, Postdoctoral Fellow,

- Dr. Naorem Santa, Postdoctoral Fellow, School of Medicine, University of Missouri, USA
 - Dr. Laishram Tomba Singh, Postdoctoral Fellow, Pohang University of Science and Technology, South Korea
 - Dr. Sapam Ranjita Chanu (married to Dr. Tomba Laishram), Postdoctoral Fellow, Observatoire de Paris, France
 - Dr. Thotreingam Kasar, Postdoctoral Fellow, University of Loraine, France
 - Dr. Thangal Yumnachha, Postdoctoral Fellow, Wayne State University, USA
 - Dr. Pushpa Pukhrambam, Taiwan
 - Dr. Krisnadas, South Korea
5. List of Manipuri PhD students studying outside the country:
- George, PhD Student, University of Missouri, USA
 - Jananjoy Rajkumar, PhD Student, Ecole de Technologie superieure, Montreal, Canada
(<https://www.linkedin.com/in/jananjoy-rajkumar-33285a24/>)

(NOTE: The above list is not complete.)

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