7.3.1: Portray the performance of the Institution in one area distinctive to its priority and thrust within 1000 words

Title: Advancement in Nuclear Science and Technology through Academic Programs

One of the distinctive characteristics of HBNI is its uniqueness as a research university, imparting knowledge and skills in the areas of nuclear sciences and engineering. HBNI was indeed established with the mission of encouraging pursuit of excellence in sciences (including engineering sciences) and mathematics in a manner that has major significance for the progress of indigenous nuclear technological capability. While HBNI academic programs provide human resource base for developing technologies relevant to nuclear power generation, programs also address strategic sector and other national mission programs, health care and other societal sectors. Nuclear science is an inter-disciplinary subject and any institute involved in its development should have expertise in several branches, viz. physical sciences, chemical sciences, life science, engineering sciences, health sciences and mathematics. Thus, scope of nuclear engineering and consequently, that of HBNI is very vast. Eleven institutions under HBNI pursue R & D in several domains by taking advantage of their academic strength in specific areas.

Research programs in DAE have to target innovations towards enhancing safety and economics of nuclear power and applications of radioactivity and radiation, and also address emerging technologies. Involvement of inquisitive and young minds in this endeavor is an important recipe for achieving breakthroughs. Establishment of HBNI and its academic governance structure has made this possible.

Unique ambience: The CIs of HBNI have a wide range of facilities ranging from tabletop set up to mega science facilities such as research reactors, accelerators, tokamaks, etc. Computational resources available to faculty and students are quite extensive and faculty is well trained to build own instrumentation and facilities. Thus, doctoral students have unique opportunity to work on frontline areas, with world class facilities, and most importantly, with practicing professionals as guides. As a result, academic programs of HBNI have been able to deliver a lot in terms of research output. Increasing intake of doctoral students has contributed towards realizing the full potential of research infrastructure available and helped in accelerating development of indigenous technologies.

Emphasis on merit: HBNI is a research university and educates students at doctoral and masters level, and pursues research in accordance with the above discussed mandate. It is meritocratic in hiring and promotion of faculty, admission and progression of students and all other policy aspects. As a result, it has a high concentration of talent in its faculty members and students.

Wide options: DAE has pursued a science-based approach for development of nuclear power programme including associated fuel cycle. HBNI students have extensive options to choose their research topics related to technology of nuclear reactors and nuclear fuel cycle and underlying science. The knowledge and skills acquired in academic programs by employee students also empower them to take up hi-tech projects including design, construction, quality assurance as well as operation of nuclear facilities. This approach has given India confidence to construct nuclear reactors, as well as entire range of fuel cycle facilities based on indigenous technology.

Indigenous development: Technology control regime is a challenge for development of nuclear technology, and it is necessary to develop complete range of technologies based on indigenous efforts. While nuclear technologies have applications in generation of nuclear power, radioactivity and radiation sources have a great variety of applications that provide immense societal benefits. To realize the full potential of nuclear energy development, research is required in a variety of disciplines, including life sciences, chemical sciences, physical sciences, engineering sciences and medical and health sciences, with emphasis on multidisciplinary research. Mathematics is basic to all branches of sciences and serious research in pure and applied mathematics including theoretical computer science is particularly important for indigenous development of information technologies and for cyber security. It is also necessary to pursue inter-disciplinary scientific studies on environmental, economic, technological and social issues. It is a distinct characteristic of HBNI that its students carry out research in these areas to promote nuclear science and technology.

Basic research: The CIs/OCC of HBNI continue to pursue basic research in frontline areas such as nuclear physics, accelerator physics, laser physics, astrophysics, biophysics, string theory, quantum information and computation, pure and applied mathematics, theoretical computer science, atomic/ molecular clusters, generation and storage of hydrogen, molecular mechanisms of abiotic stress tolerance, development and characterization of transgenic plants, oncology and nuclear medicine, and many other areas including some areas that may be classified as blue sky research. However, these research programs also provide valuable inputs for the indigenous development of nuclear science and technology.

The distinctive characteristics of HBNI described above have translated into a success story, some elements of which are described below:

- A significant percentage of students of the Institute are either employees or potential employees of the CIs. The advent of HBNI has served to enhance research contributions of employees through academic programs.
- 65% of doctoral students of HBNI, as on date, are non-employee students. The knowledge and skills imparted to these students is making a significant contribution to human resource scenario in the country, besides providing DAE young minds to address its research challenges.

- Application of nuclear techniques in health sciences is a success story, especially in the area of diagnosis and treatment of cancer. After the establishment of HBNI, TMC and BARC have increased the number of student intake in this area manyfold, which has benefited the country by increasing availability of specialist doctors in various parts of the country. There is also great demand in medical establishments for students of professional courses run by HBNI, such as, Diploma in Radiological Physics (DipRP) and Diploma in Medical Radio Isotope Technique (DMRIT).
- The publication profile of the University is very impressive in its content and also admirable in terms of its diversity. Average total number of journal publications is around 2300 per year with a h-index of the institute is 65.
- A large number of faculty members have received various awards and recognitions for their work including Academy Fellowships and Civilian Awards.