List of Equipment

	Name of the equipment	Justification	Quantity
1	CD spectrometer	Circular dichroism is one of the most heavily used techniques in understanding the changes in structures of biomolecules at low resolution. This method is used to rapidly detect changes or content of secondary structures in protein and nucleic acids. It can also be used to investigate charge transfer or electronic transfer processes. It can also inform about large changes in tertiary structures of proteins. There are multiple users for the same in BI. We have also witnessed rush of users for the CD instrument from adjoining institutes/universities in the city.	1
2	Peptide synthesizer	Peptides are important tools in different aspects of life science research. They can be used as antimicrobial agents, can be used as drugs, may be used as model systems to study fibril formation etc. To achieve such goals, researchers need to synthesize many different variants of peptides, often with unnatural amino acids or containing unnatural linkages. There are multiple users from the institute as well as from other organisations in the region.	1
3	Tip-Enhanced Raman Spectroscopy (TERS)	TERS is a state-of-the-art Raman facility for label-free super-resolution physical and chemical imaging of nanomaterials and biological samples.The new facility will provide a platform for interfacial research on nanobiology.This will be a unique facility at Bose Institute.This new facility will be used by the scientists of physical, chemical and biological sciences in Bose Institute.	1
4	Water Bath Sonicator for Genomic DNA Shearing	The specialized sonicator is used for shearing genomic DNA, chromatin etc in a controlled manner to produce desire length of ds DNA and is useful for many laboratories in the institute. Thus, the equipment will be immensely useful for the entire bioscience research community.	1
5	Live Cell Imaging & Analysis Instrument	A live cell imaging cum analysis instrument combines age old lab tested protocols and reagents with powerful automatic imaging and analysis. These instruments have the capability of imaging live cells for	1

		differential times ranging from hours to weeks, while inside the incubator. Data acquired is usually saved remotely in a computer. Various cell based assays are possible - kinetic studies in cell migration, apoptosis induction, proliferation, neuronal activity, chemotaxis etc. Both fluorescent and non-fluorescent imaging and analysis are possible. Presently, BI does not have such a facility, and hence would need this instrument which will cater to all scientists carrying out cell biology related studies.	
6	Mass photometer	The equipment is useful for 1) Sample characterization 2) Protein oligomerization 3) Biomolecular interactions 4) Macromolecular assemblies. This equipment is a new innovation and would be useful for any biological laboratory.	1
7	Automated Microbial Colony Counter	Almost all scientists of Biology at Bose Institute work with microorganisms for various purposes, ranging from purely microbiological researches to those using microbes as tools for biochemistry, biophysics, molecular biology and genetics. In all these workflows counting microbial colonies during growth is a routine job that is currently rendered via tedious, time-consuming and intellectually less-productive human labour. Use of an Automated Microbial Colony Counter in such endeavours can not only expedite our experimental procedures but also help us get much more accurate, and hence reliable, data.	1
8	Hybrid detectors for SP8 confocal	The older generation detectors on the SP8 confocal limit the use of the microscope as most users are no longer satisfied with the quality of images this system produces, compared to those of the newer Stellaris 5 confocal. The main impediment to desired imaging quality is the low quantum efficiency of the detectors. Upgrading to the HyD detectors, which have considerably more quantum efficiency, will make the two platforms (SP8 and Stellaris 5) equally useful. This will extend the life of both confocal microscopes. Two detectors are needed as most researches do colocalization experiments where two fluorophores are imaged simultaneously.	1
9	Z galvo stage	Provides fast and accurate z-scanning. This will enable the current confocal system to	1

		generate more precise 3D imaging. 3D imaging is fast emerging as a powerful tool to understand cellular processes and many events and subcellular features cannot be deciphered without 3D imaging. The Z galvo stage will enable more accurate 3D image acquisition and help our researchers make even more meaningful contributions to science.	
10	Field Emission Scanning Electron Microscopy (ESEM) with Electron Beam Lithography (EBL) Capable of Working at High Pressure	• FESEM (low pressure to high pressure) is a state-of-the-art microscopy facility for the research on chemical, biochemical, material and nano-sciences. • The new facility will provide a platform for interfacial research on nanobiology. • The available 15 years old SEM cannot be upgraded to study material at high pressure. • This new facility will be used by the scientists of physical, chemical and biological sciences in Bose Institute. • This would be placed in the CIF of the Institute to provide the access to the external researcher. • This facility will provide us with the opportunity to train human resource. • A significant amount of revenue will be earned through providing service to the external users.	1
11	X-ray Crystallography Core Facility	Crystallization of proteins require high throughput screening. Robotics for preparation of screens, setting up crystallization trials using nanolitre volumes and automated monitoring of the drops therefore becomes an indispensable necessity for difficult targets. In contrast to X-ray crystallography, small angle X-ray scattering data does not require any crystals and can be obtained in solution. This low-resolution method can provide complimentary structural information to that of X-ray/NMR and also acts an indispensable tool to understand structural dynamics of macromolecules. As mentioned above, such a cutting-edge facility is unavailable in this part of the country. Thus, BI can allow users from academia and industry on pay-per-use basis which will make it financially self-sustainable and help the institute earn revenue.	
12	EM Facility	200 kV cryo-TEM with 4KX4K CMOS and	

		other accessories, including 5yr. warranty, with Direct Electron Detector and Imaging Filter and an additional TEM for negative stain and cryo-screening Specimen preparation systems Dedicated Computer Cluster for Initial Data Processing and Data Storage System Site Preparation: High resolution cryo-TEM instrument needs to be housed in specially-made room to minimize noise from the surroundings, like temperature variation, vibration etc. To attain high resolution a microscope operating at 300 or 200 KV is necessary. It is also necessary that all the microscope components like the FEG, the lenses and other optical elements, vacuum system and the cryo stage, are digitally controlled. In addition, the system must be equipped with an autoloader for uninterrupted data collection. The system must have at least two cameras, one for collecting data (Direct Electron Detector) and another 4K X 4K CMOS camera to screen specimens. We require other accessories essential at different stages of specimen preparation. It includes, but not limited to, glow discharge system, plasma cleaning system, automated and semi-automated grid freezing, sputter coater and carbon evaporation unit, ultra-microtome unit, high pressure freezing unit etc.). State of the art ultramicrotome devices that will help making tissue samples for both room temperature and cryo-EM imaging. Both single particle analyses and tomography experiments require substantial computation resources. The facility will require dedicated high-performance cluster with at least 4 professional GPU cards and at least 1 Petabyte of storage space.	
13	Green house with climate control system	Studying plants for multiple generations is essential for obtaining meaningful data regarding its properties. Many model crops and plants undertaken in this WP have specific climatic condition requirements for their growth and reproduction. Requirements to follow these plants for multiple generations necessitate creating thoroughly-controlled artificial environment that can only be achieved by high precision greenhouse with automatic control of climatic condition set up.	
14	Portable	Comparison of physiological parameters	1

	photosynthesis system	between a healthy and stressed plant, as well as wild type and transgenics are essential component of WP1. Such an advanced instrument to screen a large number of plants currently is not available in our institute. Due to the lack of a suitable instrument we now rely on visual assessments and crude measurements of plant growth parameters, which are not acceptable for publication in standard journals. This instrument is capable of precisely measuring multiple physiological parameters, including photosynthetic efficiency and transpiration rate. Such facility is not available in the region and will be an invaluable addition in the plant research community.	
15	Super-resolution Microscope with white light laser for recording spatial, temporal, spectral and intensity information in live cells	Super-resolution microscopes deliver images that have farsuperior spatial resolution (~100 nm) than the conventional, diffraction-limitedconfocal microscopes (~300 nn).Such data will help us to publish in the top-rated journals as super-resolution images provide unequivocal support for establishing if two proteins colocalize within the cell. Additionally, many of the work packages contain objectives that require the observation of multiple biomolecules simultaneously, while resolving their spatial and temporal distribution in the context of a living cell. To achieve this goal, the system must include multiple high-efficiency detectors and also ultra-fast scanners. With the ever-increasing list of fluorescent protein tags, the availability of a super-resolution microscope with a white light laser source, tunable excitation filtering, tunable beam-splitting and tunable emission-detection – will provide us the flexibility to optimize the use of fluorescent tags for colocalization, without the need to compensate for spectral overlap. Availability of such a system, in the eastern and north-eastern region, will be extremely beneficial for the scientific community and help Bose Institute to earn revenue.	1
16	Droplet digital PCR system	Bose Institute presently carries out frontier research in diverse areas of cell and molecular biology in multiple prokaryotic and eukaryotic systems. These include organisms such as Mycobacteria, Archaea, diverse animal cell lines, plants such as Arabidopsis, tobacco, rice, tomato, lentils, etc. Accurate quantification of gene expression is required on a routine basis for molecular biology studies, and forms the	1

		foundation for understanding the diverse pathways of development, stress tolerance, disease progression, etc. Traditional qPCR-based quantification of gene expression is a laborious method and requires extensive optimisation to understand the absolute gene expression level. Next-generation sequencing data is a viable option but is prohibitively expensive and cannot be utilised on a regular basis. Under such a scenario, the digital droplet PCR system can be a beneficial, cost-efficient, and robust alternative to undertake absolute gene quantification on a regular basis. The system performs parallel PCR reaction in thousands of nanoliter-sized PCR droplets thereby quantifying absolute gene expression levels utilising the Poisson statistics and proprietary algorithms. It eliminates the need for calibration standards or keeping endogenous housekeeping genes for quantification. Consumable and equipment costs are lower than chip-based digital PCR systems. Therefore, the purchase of this instrument is recommended on an urgent basis to accelerate progress of research in the institute.	
17	Databases & Software	Database access and software for genome, proteome, transcriptome analysis, molecular dynamics and docking studies, electron microscopy, analysis of images and pathways.	
18	Flow cytometer (analyser and sorter)	Flow cytometer utilizes immunological principles to differentially assess cell populations, broadly on the basis of size and granularity, and more specifically on the basis of expression of cell surface markers. This enables quantitative analysis of not only differential cell populations in a milieu of heterogeneous cell types, but also is widely used to quantify expression of specific proteins in the concerned cell population. A wide variety of assays including but not limited to quantifying apoptosis, cell cycle, marker analysis, cell proliferation and stemness characteristics etc are possible with this instrument. The present flow cytometer is more than 10 years old and is near the end of its life expectancy, both mechanically as well as technologically. Hence, the immediate need for procurement of a flow cytometer keeping in mind the wide range of applications from various areas of biological science.	1

19	Small Animal whole body imager (PET/CT)	The current proposal requires the translation of experiments into in vivo system, which involves experimentation with small animals like mice, rat, hamster etc. For such in vivo studies, a small animal whole body imager (PET/CT) is essential.	1
20	Data centre, including storage and high-performance computing, with necessary supporting infrastructure	Efficient execution of WPs involves image analyses, computational biology and bioinformatics approaches, involving wide range of computational methods like molecular modelling and design, structure determination, molecular dynamics, database design, annotation and would also utilize machine learning and artificial intelligence-based prediction methods. It would require a moderate setup of a data centre that include data archiving facility as well as high performance computing facility. Bose Institute does not have such central facility yet that could cater computing services to all the faculty members (only limited facility from individual's project is available so far). Since the institute is going to move to new campus where there will be ample place to setup such a facility, the plan could be extended for a large data centre to serve the research institutes of eastern India, which facility is not yet available in this part of India.	
21	Instrument system for mechanical and electronics facility	To design, build, repair the mechanical and electronic instruments by the researchers themselves. It will save time and resources for customized mechanical and electronic devices.	
22	Ageing measurement facility fully equipped with DAQ	This set-up will be necessary for ageing measurements of gaseous detectors that we will be used in heavy ion experiments. There will be facility for accelerated charge accumulation in shorter time using high rate of radiation but in a controlled environment. This will be a national facility of any kind of gaseous detector in India. At present such ageing facility is available only at CERN, Switzerland; GSI, Germany and Amsterdam. Since India is one of the countries in the world producing different gaseous detectors for different particle physics experiments, so this system will be useful for other collaborating institutes and the system can generate revenue for the institute.	
23	System for GEM foil production using photolithographic	Instrument system for GEM foil production is one of the main components of the proposed WP. In eastern part of India there is no GEM foil production system.	

	technique	Once it is set up, we can build the GEM foils needed to build GEM detectors. Successful production of GEM foil will enable the institute supply GEM foils to other institutes for research and earn revenue.	
24	Nuclear astrophysics facility:	The facility at Bose Institute is essential to complement nuclear astrophysics studies carried out at accelerators like CERN-ISOLDE and GANIL. The response of the detectors is to be studied at the facility to complement experiments in the accelerators. The facility would also be useful to study beta-gamma coincidence.	
25	Single Particle Soot Photometer	For real-time monitoring of the black carbon or soot particles portioned into aged or coated soot and freshly emitted soot particles. This would help us to understand the contributions from the local emissions as well as the contributions from the long-range transport.	
26	Aerosol Chemical Speciation Monitor	For determining the real-time mass of major inorganic and organic compounds of aerosols in order to understand the effect of aerosol chemistry on the formation of cloud, as well as the effect of aerosol chemical compounds in the modification of cloud microphysical properties.	
27	Cloud Droplet Probe	For real-time monitoring of cloud microphysics, like cloud droplet size and number to understand the role of aerosols on microphysical changes of clouds. Isotope analyser would be used to better understand the cloud water isotopic fractionation process. Instruments are not available locally. The data generated will be of national importance.	
28	Wideband integrated bio-aerosol sensors	For determination of bioaerosol concentrations on real time basis. Eastern Himalaya is a good emitter of bio-aerosols because of its huge biosphere cover. Instruments are not available locally. The data generated will be of national importance.	
29	Ion Chromatograph and accessories	Aerosol samples collected from various sites or ecosystems could be analysed in terms of water-soluble inorganic and organic species using ion chromatograph. Ion chromatograph could also be used to detect and quantify the market compounds associated with various emission sources of aerosols.	
30	RH controlled Nephelometer	Provides real-time spectral values of scattering coefficients in micro-scale with a very high-resolution time interval (1-min), which are prime natural quantum scattering	

		processes under WP3. It is a very sophisticated modern instrument that provides the scattering within entire visible radiation. Combination of Aethalometer and Nephelometer provides a great opportunity to investigate perturbation in Earth's radiation budget.	
31	Optistat equipped with 9T superconducting magnet	For the temperature and magnetic field dependent optical spectroscopy, this instrument is necessary.	
32	Nanofabrication:	For the nanofabrication, all the instruments listed here are essential. Some of the instruments are available in the nearby institutes, but nanofabrication recipe is extremely sensitive to the environmental conditions. The recipe will change in different laboratory. To get an optimum recipe, a lot of standardizations are required. Therefore, all the instruments are needed in one clean room.	
33	Optical and Electron beam lithography facility	For the nanofabrication, all the instruments listed here are essential. Some of the instruments are available in the nearby institutes, but nanofabrication recipe is extremely sensitive to the environmental conditions. The recipe will change in different laboratory. To get an optimum recipe, a lot of standardizations are required. Therefore, all the instruments are needed in one clean room. Dedicated cluster is essential to carry out the numerical simulation and data analysis for each of the mentioned work plan	
34	ICPRIE	For the nanofabrication, all the instruments listed here are essential. Some of the instruments are available in the nearby institutes, but nanofabrication recipe is extremely sensitive to the environmental conditions. The recipe will change in different laboratory. To get an optimum recipe, a lot of standardizations are required. Therefore, all the instruments are needed in one clean room. Dedicated cluster is essential to carry out the numerical simulation and data analysis for each of the mentioned work plan	
35	Wire bonder, microscope, thermal evaporator, spin coater, vacuum systems, Spare parts and optical	For the nanofabrication, all the instruments listed here are essential. Some of the instruments are available in the nearby institutes, but nanofabrication recipe is extremely sensitive to the environmental conditions. The recipe will change in different laboratory. To get an optimum	

	components	recipe, a lot of standardizations are required. Therefore, all the instruments are needed in one clean room. Dedicated cluster is essential to carry out the numerical simulation and data analysis for each of the mentioned work plan	
36	List of equipments for radioactive facility	List of equipments needed for radioactive usage room (Annexure I)	
37	Mammalian cell culture facility	Mammalian cell culture facility is needed for everyday maintenance, growth and culture of mammalian cell, cancer cells, both adherent and suspension, as well as isolation and culture of cells from primary cancer tissues. Individual facility is needed for 16 scientist of the institute. Presently no such facility is available at Unified academic campus.	
38	Biosafety level 2 lab facility (BSL-2)	Several researchers of Bose Institute need a dedicated Biosafety Level 2 lab (BSL-2) facility for their research. BSL-2 lab is a must requirement for working with human samples (like sputum, blood, tissues), risk category level –II microbes, and environmental samples (air/water). There is an assigned P-2 lab in room no. 642 (sixth floor). To make this room a BSL-2 lab, a few equipment are required like a Biosafety cabinet, cold centrifuge, sonicator, refrigerator, pipettes sets, dustbins. The BSL-2 lab also requires a sink for handwashing, bench tops, lab furniture (like chairs, benches, and cabinets), proper lights and ventilation	

Annexure I

List of equipment required for the radioisotopes-usage room

Sl	Particular of Assets	Qty
1	Scintillation counter	1
2	table top centrifuge (refrigerated)	1
3	table top centrifuge (non-refrigerated)	1
4	Thermal Cycler PCR	1
5	Dry bath	4
6	20C Freezer	2
7	Refregerator	2
8	Vertical gel running system	2
9	GM counter 2 nos	2
10	High voltage power supply	1
11	Gel Dryer	1
12	Hybridization oven	1