Scheme for Transformational and Advanced Research in Sciences(STARS)

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Scheme for Transformational and Advanced Research in Sciences (STARS) **for promoting translational, India-centric research in Sciences, to be implemented and managed by the Indian Institute of Science (IISc), Bangalore.**

Objectives

1. To fund science projects which are translational, i.e. which have direct implications for the progress of the country, through a competitive process in an open and transparent manner.
2. Basic thrust would be to take stock of an existing problem and work backwards towards conducting research for a solution.
3. Promoting an inter-disciplinary & translational approach in research for synergy, de-duplication and greater comprehensiveness & relevance of research activity.
4. Orient science towards addressing needs & issues of the country in key sectors like health, agriculture, energy, environment, security, etc.

Thrust areas

With the key objective of supporting socially relevant research, the following 6 basic thrust areas have been identified: Physics, Chemistry, Biological Sciences, Nanosciences, Data Sciences & Mathematics, and Earth Sciences.

Physical Sciences:

Priority Areas

- Quantum Technologies: Quantum Information Sciences, Quantum Computing, Quantum Communication and Quantum Sensing.
- Photonics and Quantum Photonics.
- Designing Self Assembled Functional Materials / Robotics with Control and Adaptation, Reprogrammable Group/Collective Dynamics Soft Engineering, Reprogrammable Soft Materials, Physics of living systems.
- Advanced Hard Materials (smart/high strength / Energy storage and harvesting). Topological matter, novel superconductors.

Chemical Sciences:

Major Goal: Ability to design and manipulate matter using principles of chemistry

Energy Conversion and Storage

- Understanding Electron / Ion Coupled Transport in various systems.
- Catalysis – Development of novel catalysts for dinitrogen and C=O bond activation.
- Chemical/photochemical and Electrochemical aspects of conversion and storage, the role of electrolyzers and reformers / New approaches for heterogeneous catalysis, e.g., using porous organic polymers (POPs).

Biological Sciences

Priority Areas

- Nutrition and health.
- Biodiversity.
- Infectious diseases.
- Human genetics and non-communicable diseases.

- Crop protection and value addition

Nanosciences

Priority areas

- Nanoscience and technology for emerging electronics, photonics and heterogenous nanosystems.
- Nanoscience and technology for Security, Healthcare, Energy and Environment.

Earth sciences

Priority areas

- Assessment of groundwater reserves, quality assessment and projections for future leading to conservation and longevity of quality and quantity.
- Climate change through time and impacts on cultural and economic development – focus on rivers (migration of civilizations, the influence of river systems, impacts on environment and projections to future); evolve strategies for management of the river basins.
- Accounting for the Himalayan glaciers and their vulnerability; avalanche hazard zonation; retreat of glaciers and long-term impact on river water budgets, potential remedial measures.
- Landslide risk zonation, construction, and development-roadmaps to the development of vulnerable regions.
- Protection of coastal zones- mapping the limits of coastal inundation from sea surges (cyclones and tsunamis) considering sea-level changes in the past and projections to future based on climate change models, surface water-aquifer interactions, submarine groundwater discharge, and saltwater intrusion into coastal aquifers in response to sea-level dynamics.
- Environmental impacts of resource exploitation (mining, quarrying, land reclamation, soil degradation, etc), remedial measures.

- Earthquake and tsunami hazards-mapping the vulnerability zones and impact assessment, increasing preparedness through outreach programs and policy options.
- Geology and our cultural evolution-river systems and ancient civilizations; development of our heritage structures, building stones, our geological heritages (potential contributions to the natural history museum in the plan).
- Interactions among surface processes, climate, and tectonics with focus on human sustainability- coupled surface process-tectonic models, mechanics of erosion, fluvial terrace systems, sedimentary basins, and their architecture.
- Develop a unifying theoretical framework of Critical Zone evolution that integrates physical, chemical and biological processes. Develop coupled system models to explore how CZ services respond to anthropogenic, climatic and tectonic forcings and to develop extensive integrated datasets to document a wide range of CZ settings, including geology and climate.