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GENERAL STUDIES

PAPER - III

(TECHNOLOGY, ECONOMIC DEVELOPMENT, BIO DIVERSITY, ENVIRONMENT, SECURITY & DISASTER MANAGEMENT)

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GENERAL STUDIES - III
(Technology, Economic Development, Bio diversity, Environment, Security & Disaster Management)

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TECHNOLOGY

SCIENCE AND TECHNOLOGY

Developments and their applications and effects in everyday life

In India there has been a long and distinct tradition of scientific research and technological advancement since ancient times. Since independence, we have accelerated our speed and efforts in this field and have established many research laboratories, institutions of higher learning and technical education. The results have been such as would make anybody's heart swell with pride, confidence and a sense of fulfillment. The best, however, is yet to come.

The central and state governments, various public and private sector establishments are engaged in scientific research and technological development to take the nation on the path of rapid development, growth and prosperity. There are about 200 research laboratories spread all over the country. The institutions of higher learning, and universities, the modern temples of learning, are all committed to take the country forward. They are well equipped and staffed to secure for the people of the nation all the blessings and benefits that can accrue from the acquisition and application of scientific knowledge and technology. But there is no room for complacency, for in this field only the sky is the limit and we are yet a developing country.

Our technology policy is comprehensive and well thought out. It aims at developing indigenous technology to ensure efficient absorption and adoption of imported technology suitable to national priorities and availability of resources. Its main objective is attainment of technical competence and self- reliance, leading to reduction in vulnerability in strategic and critical areas. With a view to strengthening our economy and industrial development, our government has introduced many structural reforms through adoption of a new industrial policy which has an important bearing on the programmes of development pertaining to science and technology. Consequently, technology has become our mainstay enterprise and now we have built a strong and reliable infrastructure for research, training and development in science and technology.

In the field of agriculture, our scientific and technological researches have enabled us to be self-reliant and self-sufficient in food grains. Today, we can withstand droughts and natural calamities with much greater confidence than ever before. Now, we are in a position to export food grains, etc. and are on the threshold of white and blue revolutions. Thanks to our agricultural scientists and farmers, always ready to imbibe new technologies, we have many varieties of hybrid seeds, crop- protection technologies, balanced farming practices and better water and irrigation management techniques. Similarly in the field of industrial research, we have achieved many milestones and India is emerging as a major industrial power of the world. The Council of Scientific and Industrial Research (CSIR), with its network of research laboratories and institutions, has been chiefly instrumental in our major achievements in scientific and industrial research. We have now joined the exclusive club of six advanced nations by developing our own super computer at the Centre for Development of Advance Computing (C-CAD) at Pune.

Our Atomic Research Commission, set up in 1948, is engaged in valuable nuclear research for peaceful purposes. The executive agency for implementing atomic energy programmes is the Department of Atomic Energy. The Bhabha Atomic Research Centre, Trombay, near Mumbai is the biggest single scientific establishment in the country, directing nuclear research. Now, we have five research reactors, including Cirus, Dhruua, Zerina and Purnima. We have carried out two underground nuclear tests at Pokharan in Rajasthan. This is a remarkable achievement by our nuclear scientists, which has enabled us to become one of the selected few countries of the world to have done it. India is also the first developing country, and one of the seven countries of the world to master fast breeding technology. Research in breeder technology is currently going on at Indira Gandhi Centre for Atomic Research at Kalpakkam, Chennai.

The successful launching of Polar Space Launching Vehicle (PSLV- D-2), in October 1994, marked India's entry into the league of the world's major space powers. In the INSAT-2 series of satellites, launched first in 1992, India has shown its ability to fabricate complex systems comparable to anything made anywhere in the world. Our previous launches of the SLV-3 and the SLV were merely stepping stones to what will be the workhorses of the business, the PSLV, which can launch one tone satellite into orbit of up to 1000 km, and the

Geosynchronous Satellite Launch Vehicle, which can take 2.5 tonne satellite to orbits 36,000 km away. India's space programme rocketed to greater heights with the successful launch of the second Geosynchronous Satellite Launch Vehicle (GSLV-D2) in May, 2003. As has been rightly observed, the challenge before Indian Space Research Organisation (ISRO) is to maintain the momentum of the programme by integrating it with other missions. The most obvious ones are related to military communication and reconnaissance.

Our success on Antarctica speaks volumes of our scientific genius and technological wisdom in the field. So far, 13 scientific expeditions by our oceanographers, scientists and technicians have been to Antarctica and we have two permanent stations on the icy continent.

In the field of defence also our achievements have been quite laudable. The successful production of such missiles as Prithvi and Nag testify to the high capabilities and achievements of our scientists. We have also been successful in producing opt-electronic fire control and night-vision devices required for our indigenous tanks. The HAL at Bangalore has already produced Advanced Light Helicopter (ALH).

TECHNOLOGY POLICY

Technology Policy Statement (TPS) was formulated in 1983 with the basic objective of developing indigenous technology and ensuring efficient absorption and adaptation of imported technology appropriate to national priorities and availability of resources. It is aimed at attaining technical competence and self-reliance, reducing vulnerability particularly in strategic and critical areas and making maximum use of indigenous resources. The TPS also aims at using traditional skills and capabilities making them commercially competitive.

Several other measures through technology-intervention are envisaged to optimise demand on energy and ensure harmony with the environment. With a view to strengthening the economy, structural reforms have been introduced through adoption of a new industrial policy which will have an important bearing on the programmes of development pertaining to science and technology. A Technology Policy is being formulated to provide focus on the development of indigenous technologies and to make India self-reliant and competitive in the technological field.

Science and Technology Policy 2003

Hon'ble then President of India, Dr. A.P.J. Abdul Kalam "Today India has become one of the strongest in the world in terms of scientific manpower in capability and maturity. Hence, we are in a position not only to understand the technologies that we may have to borrow, but also to create our own technologies with extensive scientific inputs of indigenous origin. Basically we have come a long way since our independence, from mere buyers of technology to those of who have made science and technology as an important contributor for national development and societal transformation. In a world where the powers are determined by their share of the world's knowledge, reflected by patents, papers and so on, the WTO starts to play a crucial role in the economic development. It is important for India to put all her acts together to become a continuous innovator and creator of science and technology intensive products".

A - PREAMBLE

Science and technology have profoundly influenced the course of human civilization. Science has provided us remarkable insights into the world we live in. The scientific revolutions of the 20th century have led to many technologies, which promise to herald wholly new eras in many fields. As we stand today at the beginning of a new century, we have to ensure fullest use of these developments for the well being of our people.

Science and technology have been an integral part of Indian civilization and culture over the past several millennia. Few are aware that India was the fountainhead of important foundational scientific developments and approaches. These cover many great scientific discoveries and technological achievements in mathematics, astronomy, architecture, chemistry, metallurgy, medicine, natural philosophy and other areas. A great deal of this traveled outwards from India. Equally, India also assimilated scientific ideas and techniques from elsewhere, with open-mindedness and a rational attitude characteristic of a scientific ethos. India's traditions have been founded on the principles of universal harmony, respect for all creation and an integrated holistic approach. This background is likely to provide valuable insights for future scientific advances. During the century prior to Independence, there was an awakening of modern science in India through the efforts of a number of outstanding scientists. They were responsible for great scientific advances of the highest international caliber.

In the half century since Independence, India has been committed to the task of promoting the spread of science. The key role of technology as an important element of national development is also well recognised. The Scientific Policy Resolution of 1958 and the Technology Policy Statement of 1983 enunciated the principles on which the growth of science and technology in India has been based over the past several decades. These policies have emphasized self-reliance, as also sustainable and equitable development. They embody a vision and strategy that are applicable today, and would continue to inspire us in our endeavors.

With the encouragement and support that has been provided, there is today a sound infrastructural base for science and technology. These include research laboratories, higher educational institutions and highly skilled human resource. Indian capabilities in science and technology cover an impressive range of diverse disciplines, areas of competence and of applications. India's strength in basic research is recognized internationally. Successes in agriculture, health care, chemicals and pharmaceuticals, nuclear energy, astronomy and astrophysics, space technology and applications, defense research, biotechnology, electronics, information technology and oceanography are widely acknowledged. Major national achievements include very significant increase in food production, eradication or control of several diseases and increased life expectancy of our citizens.

While these developments have been highly satisfying, one is also aware of the dramatic changes that have taken place, and continue to do so, in the practice of science, in technology development, and their relationships with, and impact on, society.

Particularly striking is the rapidity with which science and technology is moving ahead. Science is becoming increasingly inter- and multi-disciplinary, and calls for multi-institutional and, in several cases, multi-country participation. Major experimental facilities, even in several areas of basic research, require very large material, human and intellectual resources. Science and technology have become so closely intertwined, and so reinforce each other that, to be effective, any policy needs to view them together. The continuing revolutions in the field of information and communication technology have had profound impact on the manner and speed with which scientific information becomes available, and scientific interactions take place.

Science and technology have had unprecedented impact on economic growth and social development. Knowledge has become a source of economic might and power. This has led to increased restrictions on sharing of knowledge, to new norms of intellectual property rights, and to global trade and technology control regimes. Scientific and technological developments today also have deep ethical, legal and social implications. There are deep concerns in society about these. The ongoing globalisation and the intensely competitive environment have a significant impact on the production and services sectors.

Because of all this, our science and technology system has to be infused with new vitality if it is to play a decisive and beneficial role in advancing the well being of all sections of our society. The nation continues to be firm in its resolve to support science and technology in all its facets. It recognizes its central role in raising the quality of life of the people of the country, particularly of the disadvantaged sections of society, in creating wealth for all, in making India globally competitive, in utilizing natural resources in a sustainable manner, in protecting the environment and ensuring national security.

Policy Objectives

Recognizing the changing context of the scientific enterprise, and to meet present national needs in the new era of globalisation, Government enunciates the following objectives of its Science and Technology Policy:

- To ensure that the message of science reaches every citizen of India, man and woman, young and old, so that we advance scientific temper, emerge as a progressive and enlightened society, and make it possible for all our people to participate fully in the development of science and technology and its application for human welfare. Indeed, science and technology will be fully integrated with all spheres of national activity.
- To ensure food, agricultural, nutritional, environmental, water, health and energy security of the people on a sustainable basis.
- To mount a direct and sustained effort on the alleviation of poverty, enhancing livelihood security, removal of hunger and malnutrition, reduction of drudgery and regional imbalances, both rural and urban, and generation of employment, by using scientific and technological capabilities along with our traditional knowledge pool. This will call for the generation and screening of all relevant technologies, their widespread dissemination through networking and support for the vast unorganized sector of our economy.
- To vigorously foster scientific research in universities and other academic, scientific and engineering institutions; and attract the brightest young person's to careers in science and technology, by conveying a sense of excitement concerning the advancing frontiers, and by creating suitable employment opportunities for them. Also to build and maintain centres of excellence, which will raise the level of work in selected areas to the highest international standards.
- To promote the empowerment of women in all science and technology activities and ensure their full and equal participation.
- To provide necessary autonomy and freedom of functioning for all academic and R&D institutions so that an ambience for truly creative work is encouraged, while ensuring at the same time that the science and technology enterprise in the country is fully committed to its social responsibilities and commitments.
- To use the full potential of modern science and technology to protect, preserve, evaluate, update, add value to, and utilize the extensive knowledge acquired over the long civilizational experience of India.
- To accomplish national strategic and security-related objectives, by using the latest advances in science and technology.
- To encourage research and innovation in areas of relevance for the economy and society, particularly by promoting close and productive interaction between private and public institutions in science and technology. Sectors such as agriculture (particularly soil and water management, human and animal nutrition, fisheries), water, health, education, industry, energy including renewable energy, communication and transportation would be accorded highest priority. Key leverage technologies such as information technology, biotechnology and materials science and technology would be given special importance.
- To substantially strengthen enabling mechanisms that relate to technology development, evaluation, absorption and upgradation from concept to utilization.
- To establish an Intellectual Property Rights (IPR) regime this maximises the incentives for the generation and protection of intellectual property by all types of inventors. The regime would also provide a strong, supportive and comprehensive policy environment for speedy and effective domestic commercialisation of such inventions so as to be maximal in the public interest.
- To ensure, in an era in which information is key to the development of science and technology, that all efforts are made to have high-speed access to information, both in quality and quantity, at affordable costs; and also create digitized, valid and usable content of Indian origin.
- To encourage research and application for fore-

casting, prevention and mitigation of natural hazards, particularly, floods, cyclones, earthquakes, drought and landslides.

- To promote international science and technology cooperation towards achieving the goals of national development and security, and make it a key element of our international relations.
- To integrate scientific knowledge with insights from other disciplines, and ensure fullest involvement of scientists and technologists in national governance so that the spirit and methods of scientific enquiry permeate deeply into all areas of public policy making.

It is recognized that these objectives will be best realized by a dynamic and flexible Science and Technology Policy, which can readily adapt to the rapidly changing world order. This Policy, reiterates India's commitment to participate as an equal and vigorous global player in generating and harnessing advances in science and technology for the benefit of all humankind.

Strategy and Implementation Plan

Keeping in view these broad objectives, it is essential to spell out an implementation strategy that will enable identification of specific plans, programmes and projects, with clearly defined tasks, estimates of necessary resources, and time targets. Some of the key elements of the implementation strategy will be as follows:

1. Science and Technology Governance and Investments

Suitable mechanism will be evolved by which independent inputs on science and technology policy and planning are obtained on a continuous basis from a wide cross section of scientists and technologists. It will utilize the academies and specialized professional bodies for this purpose. These inputs will form an integral part of the planning and implementation of all programmes relating to science and technology, as also in government decision making and formulation of policies in socio-economic sectors.

A greater integration of the programmes in socio-economic sectors with R&D activities will go a long way in ensuring a wider, more visible and tangible impact. This will call for a certain percentage of the overall allocation of each of the socio-economic ministries to be devoted for relevant programmes and activities in science and technology. The States will also be encouraged and assisted in the use of science and technology for developmental purposes through mechanisms set up for this, and in establishing linkages with national institutions for solving their regional and locale-specific problems.

A concerted strategy is necessary to infuse a new sense of dynamism in our science and technology institutions. The science departments, agencies and other academic institutions, including universities i.e. the science and technology system as a whole, would be substantially strengthened, given full autonomy and flexibility, and de-bureaucratized.

Mechanisms will be established to review on a continuous basis the academic and administrative structures and procedures in the science and technology system at all levels, so that reforms could be effected to meet the challenges of the changing needs.

It will be ensured that all highly science-based Ministries/Departments of Government are run by scientists and technologists. All the major socio-economic Ministries will have high-level scientific advisory mechanisms.

Government will ensure continued existence of an Apex S&T Advisory Body which will assist in formulating and implementing various programmes and policies. It will have appropriate representation of industry leaders, leading scientists and technologists and various scientific departments.

Government will make necessary budgetary commitments for higher education and science and technology. It will, through its own resources and also through contribution by industry, raise the level of investment to at least 2% of GDP on science and technology by the end of the Tenth Plan. For this, it is essential for industry to steeply increase its investments in R&D. This will enable it to be competitive, achieve greater self-reliance and self-confidence, and fulfill national goals.

2. Optimal Utilization of Existing Infrastructure and Competence

Science and technology is advancing at a very fast pace, and obsolescence of physical infrastructure, as also of skills and competence, take place rapidly. Steps will be taken to network the existing infrastructure, investments and intellectual strengths, wherever they exist, to achieve effective and optimal utilization, and constantly upgrade them to meet changing needs.

3. Strengthening of the Infrastructure for Science and Technology in Academic Institutions

A major initiative to modernize the infrastructure for science and engineering in academic institutions will be undertaken. It will be ensured that all middle and high schools, vocational and other colleges will have appropriately sized science laboratories. Science, engineering and medical departments in academic institutions and universities and colleges will be selected for special support to raise the standard of teaching and research. To begin with, a significant number of academic institutions, specially the universities, as also engineering and medical institutions, would be selected for this support to make an impact. Flexible mechanisms for induction of new faculty in key areas of science would be developed. Constancy of support and attention will be ensured over at least a ten-year period.

4. New Funding Mechanisms for Basic Research

The setting up of more efficient funding mechanisms will be examined, either by creating new structures or by strengthening or restructuring the existing ones, for promotion of basic research in science, medical and engineering institutions. In particular, administrative and financial procedures will be simplified to permit efficient operation of research programmes in diverse institutions across the country.

Creation of world class facilities in carefully selected and nationally relevant fields will be undertaken, to enhance our international competitiveness in areas where we have strengths, opportunities or natural advantages. Indigenous expertise will be used to the maximum extent possible. This would help in nurturing high quality talent and expertise in experimental science and engineering.

5. Human Resource Development

The number of scientists and technologists, while being large in absolute numbers, is not commensurate with the requirements in quality and when measured on a per capita basis. The demand is bound to increase in the coming years with more intensive activities involving science and technology. There is need to progressively increase the rate of generation of high quality skilled human resource at all levels. This process would naturally entail reversing the present flow of talent away from science, by initiating new and innovative schemes to attract and nurture young talent with an aptitude for research, and by providing assured career opportunities in academia, industry, Government or other sectors. In order to encourage quality and productivity in science and technology, mobility of scientists and technologists between industry, academic institutions and research laboratories will be ensured.

For building up the human resource base in relevant areas, the agencies and departments concerned with science and technology will make available substantial funding from their allocation. Flexible mechanisms will be put in place in academic and research institutions to enable researchers to change fields and bring new inputs into traditional disciplines, and also to develop inter-disciplinary areas. There will be emphasis on a continuing process of retraining and reskilling to keep pace with the rapid advances taking place. Wherever considered necessary, training abroad will be resorted to, so as to build up a skilled base rapidly.

Women constitute almost half the population of the country. They must be provided significantly greater opportunities for higher education and skills that are needed to take up R&D as a career. For this, new procedures, and flexibility in rules and regulations, will be introduced to meet their special needs.

New mechanisms would be instituted to facilitate the return of scientists and technologists of Indian origin to India, as also their networking, to contribute to Indian science and technology.

Schemes for continuing education and training of university and college teachers in contemporary research techniques and in emerging areas of science will be strengthened and new innovative programmes started.

It will also be ensured that higher education is available to the widest possible section of creative students, transcending social and economic barriers.

6. Technology Development, Transfer and Diffusion

A strong base of science and engineering research provides a crucial foundation for a vibrant programme of technology development. Priority will be placed on the development of technologies which address the basic needs of the population; make Indian industries - small, medium or large - globally competitive; make the country economically strong; and address the security concerns of the nation. Special emphasis will be placed on equity in development, so that the benefits of technological growth reach the majority of the population, particularly the disadvantaged sections, leading to an improved quality of life for every citizen of the country. These aspects require technology foresight, which involves not only forecasting and assessment of technologies but also their social, economic and environmental consequences.

The growth rate in productivity of the Indian economy has been below its true potential, and the contribution to it of technological factors is inadequate. Similarly, Indian exports today derive their comparative advantage through resource and labour rather than through the power of technological innovation. The transformation of new ideas into commercial successes is of vital importance to the nation's ability to achieve high economic growth and global competitiveness. Accordingly, special emphasis will be given not only to R&D and the technological factors of innovation, but also to the other equally important social, institutional and market factors needed for adoption, diffusion and transfer of innovation to the productive sectors.

Intensive efforts will be launched to develop innovative technologies of a breakthrough nature; and to increase our share of high-tech products. Aggressive international bench-marking will be carried out. Simultaneously, efforts will be made to strengthen traditional industry so as to meet the new requirements of competition through the use of appropriate science and technology. This industry is particularly important as it provides employment at lower per capita investment, involves low energy inputs, and carries with it unique civilizational traditions and culture. Value addition, and creation of wealth through reassessment, redistribution and repositioning of our intellectual, capital and material resource will be achieved through effective use of science and technology.

Deriving value from technology-led exports and export of technologies will be facilitated through new policy initiatives, incentives and legislation. This will include intensive networking of capabilities and facilities within the country.

Rigid Quality Standards, and Accreditation of testing and calibration laboratories according to international requirements, will be given an enhanced push to enable Indian industry to avoid non-tariff barriers in global trade.

A comprehensive and well-orchestrated programme relating to education, R&D and training in all aspects of technology management will be launched. To begin with, Indian Institutes of Management (IIMs), Indian Institutes of Technology (IITs) and other selected institutions will be encouraged to initiate these programmes.

7. Promotion of Innovation

Innovation will be supported in all its aspects. A comprehensive national system of innovation will be created covering science and technology as also legal, financial and other related aspects. There is need to change the ways in which society and economy performs, if innovation has to fructify.

8. Industry and Scientific R&D

Every effort will be made to achieve synergy between industry and scientific research. Autonomous Technology Transfer Organizations will be created as associate organizations of universities and national laboratories to facilitate transfer of the know-how generated to industry. Increased encouragement will be given, and flexible mechanisms will be evolved to help, scientists and technologists to transfer the know-how generated by them to the industry and be a partner in receiving the financial returns. Industry will be encouraged to financially adopt or support educational and research institutions, fund courses of interest to them, create professional chairs etc. to help direct S&T endeavours towards tangible industrial goals.

There has to be increased investments by industry in R&D in its own interest to achieve global competitiveness to be efficient and relevant. Efforts by industry to carry out R&D, either in-house or through outsourcing, will be supported by fiscal and other measures. To increase their investments in R&D, innovative mechanisms will be evolved.

9. Indigenous Resources and Traditional Knowledge

Indigenous knowledge, based on our long and rich tradition, would be further developed and harnessed for the purpose of wealth and employment generation. Innovative systems to document, protect, evaluate and to learn from India's rich heritage of traditional knowledge of the natural resources of land, water and bio-diversity will be strengthened and enlarged. Development of technologies that add value to India's indigenous resources and which provide holistic and optimal solutions that are suited to Indian social-cultural-economic ethos will be developed.A concerted plan to intensify research on traditional systems of medicine, so as to contribute to fundamental advances in health care, and leading to commercialisation of effective products will be undertaken; appropriate norms of validation and standardization will be enforced. A purposeful programme to enhance the Indian share of the global herbal product market will be initiated.

10. Technologies for Mitigation and Management of Natural Hazards

Science and technology has an important role in any general strategy to address the problems of mitigation and management of the impacts of natural hazards. A concerted action plan to enhance predictive capabilities and preparedness for meeting emergencies arising from floods, cyclones, earthquakes, drought, landslides and avalanches will be drawn up. Measures will be undertaken to promote research on natural phenomena that lead to disasters and human activities that aggravate them. This will be with a view to developing practical technological solutions for pre-disaster preparedness, and mitigation and management of post-disaster situations.

11. Generation and Management of Intellectual Property

Intellectual Property Rights (IPR), have to be viewed, not as a self-contained and distinct domain, but rather as an effective policy instrument that would be relevant to wide ranging socio-economic, technological and political concepts. The generation and fullest protection of competitive intellectual property from Indian R&D programmes will be encouraged and promoted.

The process of globalisation is leading to situations where the collective knowledge of societies normally used for common good is converted to proprietary knowledge for commercial profit of a few. Action will be taken to protect our indigenous knowledge systems, primarily through national policies, supplemented by supportive international action. For this purpose, IPR systems which specially protect scientific discoveries and technological innovations arising out of such traditional knowledge will be designed and effectively implemented.

Our legislation with regard to Patents, Copyrights and other forms of Intellectual Property will ensure that maximum incentives are provided for individual inventors, and to our scientific and technological community, to undertake large scale and rapid commercialization, at home and abroad.

The development of skills and competence to manage IPR and leveraging its influence will be given a major thrust. This is an area calling for significant technological insights and legal expertise and will be handled differently from the present, and with high priority.

12. Public Awareness of Science and Technology

There is growing need to enhance public awareness of the importance of science and technology in everyday life, and the directions where science and technology is taking us. People must be able to consider the implications of emerging science and technology options in areas which impinge directly upon their lives, including the ethical and moral, legal, social and economic aspects. In recent years, advances in biotechnology and information technology have dramatically increased public interest in technology options in wide ranging areas. Scientific work and policies arising from these have to be highly transparent and widely understood.

Support for wide dissemination of scientific knowledge, through the support of science museums, planetaria, botanical gardens and the like, will be enhanced. Every effort will be made to convey to the young the excitement in scientific and technological advances and to instill scientific temper in the population at large. Special support will be provided for programmes that seek to popularize and promote science and technology in all parts of the country. Programmes will also be developed to promote learning and dissemination of science through the various national languages, to enable effective science communication at all levels.

A closer interaction of those involved in the natural sciences and technology, social sciences, humanities and other scholarly pursuits will be facilitated to bring about mutual reinforcement, added value and impact.

13. International Science and Technology Cooperation

Scientific research and technology development can benefit greatly by international cooperation and collaboration. Common goals can be effectively addressed by pooling both material and intellectual resources. International collaborative programmes, especially those contributing directly to our scientific development and security objectives, will be encouraged between academic institutions and national laboratories in India and their counterparts in all parts of the world, including participation in mega science projects as equal partners. Special emphasis will be placed on collaborations with other developing countries, and particularly neighbouring countries, with whom India shares many common problems. International collaboration in science and technology would be fully used to further national interests as an important component of foreign policy initiatives.

14. Fiscal Measures

Innovative fiscal measures are critical to ensure successful implementation of the policy objectives. New methods are required for incentivising R&D activities, particularly in industry. New strategies have to be formulated for attracting higher levels of public and private investments in scientific and technological development. A series of both tax and non-tax fiscal instruments have to be evolved to ensure a leap-frogging process of development. The formulation of a focused strategy and the designing of new methods and instruments requires inputs from economists, financial experts and management experts and scientists. For this purpose, the apex S&T advisory body will constitute a dedicated task-force to suggest appropriate fiscal measures to subserve the policy objectives.

15. The New Vision

To build a new and resurgent India that continues to maintain its strong democratic and spiritual traditions, that remains secure not only militarily but also socially and economically, it is important to draw on the many unique civilizational qualities that define the inner strength of India; this has been intrinsically based on an integrated and holistic view of nature and of life. The Science and Technology Policy 2003 will be implemented so as to be in harmony with our world view of the larger human family all around. It will ensure that science and technology truly uplifts the Indian people and indeed all of humanity.

PROGRAMMES OF THE DEPARTMENT OF SCIENCE AND TECHNOLOGY

The Department of Science and Technology, was set-up in May 1971 with the objective of promoting research in the new areas and to play the role of a nodal department for organising, coordinating and promoting science and technology activities in the country. Over the years, the Department

has evolved policy statements and guidelines, provided mechanisms for co-ordination in the areas of science and technology in which a number of institutions have interests and capabilities, supported grants-in-aid to scientific institutions and professional bodies. The Department has to play a catalytic and co-ordinating role and in this process over the past few years, the efforts at promoting science and technology in the States and Union Territories have also gathered considerable momentum.

ACHIEVEMENTS OF INDIANS IN SCIENCE & TECHNOLOGY

Indian scientists have played a stellar role in the development of India. In the short span of its post-independence history India has achieved several great scientific achievements. Indian scientists have proved their mettle in the face of international sanctions and have made India one of the scientific powerhouses of the world. Here is a brief profile of famous Indian scientists.

C.V. Raman

C.V. Raman is one of the most renowned scientists produced by India. His full name was Chandrasekhara Venkata Raman. For his pioneering work on scattering of light, C.V. Raman won the Nobel Prize for Physics in 1930.

Homi Bhabha

Homi Bhabha, whose full name was Homi Jehnagir Bhabha, was a famous Indian atomic scientist. In Independent India, Homi Jehnagir Bhabha, with the support of Jawaharlal Nehru, laid the foundation of a scientific establishment and was responsible for the creation of two premier institutions, Tata Institute of Fundamental Research and Bhabha Atomic Research Centre.

Jagdish Chandra Bose

Jagdish Chandra Bose was born on November 30, 1858 in Mymensingh (now in Bangladesh). His father Bhagabanchandra Bose was a Deputy Magistrate. Jagadish Chandra Bose had his early education in village school in Bengal medium.

Meghnad Saha

Meghnad Saha was born on October 6, 1893 in Sheoratali, a village in the District of Dacca, now in Bangladesh. He was the fifth child of his parents, Sri Jagannath Saha and Smt. Bhubaneshwari Devi. His father was a grocer in the village. Meghnad Saha had his early schooling in the primary school of the village.

M. Visvesvaraya

Sir M. Visvesvaraya was born on September 15, 1860 in Muddenahalli village in the Kolar district of the erstwhile princely state of Mysore (present day Karnataka). His father Srinivasa Sastry was a Sanskrit scholar and Ayurvedic practitioner. His mother Venkachamma was a religious lady. He lost his father when he was only 15 years old.

Satyendra Nath Bose

Satyendra Nath Bose was an outstanding Indian physicist. He is known for his work in Quantum Physics. He is famous for "Bose-Einstein Theory" and a kind of particle in atom has been named after his name as Boson.

Subrahmanyan Chandrasekhar

Subrahmanyan Chandrasekhar was one of the greatest scientists of the 20th century. He did commendable work in astrophysics, physics and applied mathematics. Chandrasekhar was awarded the Nobel Prize in Physics in 1983.

Vikram Sarabhai

Vikram Sarabhai was one of the greatest scientists of India. He is considered as the Father of the Indian space program. Apart from being a scientist, he was a rare combination of an innovator, industrialist and visionary.

Anil Kakodkar

Dr Anil Kakodkar is a very distinguished nuclear scientist of India. He is presently the chairman of the Atomic Energy Commission of India (AECI) as well as the Secretary to the Government of India, Department of Atomic Energy.

APJ Abdul Kalam

Apart from being a notable scientist and engineer, Dr APJ Abdul Kalam served as the 11th President of India from the period 2002 to 2007. He is a man of vision, who is always full of ideas aimed at the development of the country and is also often also referred to as the Missile Man of India.

Birbal Sahni

Birbal Sahni was a renowned paleobotanist of India, who studied the fossils of the Indian subcontinent. Also a great geologist, Sahni is credited for establishing the Birbal Sahni Institute of Palaeobotany at Lucknow in the state of Uttar Pradesh. Born on 14 November in the year 1891 at Behra in the Saharanpur District of West Punjab, Birbal was the third son of Ishwar Devi and Prof.

Srinivasa Ramanujan

Srinivasa Ramanujan was a mathematician par excellence. He is widely believed to be the greatest mathematician of the 20th Century. Srinivasa Ramanujan made significant contribution to the analytical theory of numbers and worked on elliptic functions, continued fractions, and infinite series.

Dr. Shanti Swarup Bhatnagar

Dr Shanti Swaroop Bhatnagar was a distinguished Indian scientist. He was born on 21 February 1894 at Shahpur, which is located in Pakistan in present times. His father passed away sometime after the birth of Shanti Swarup Bhatnagar. As such, he spent his childhood days with his maternal grandfather who was an engineer and it was here that he developed an interest in science and engineering.

Har Gobind Khorana

Har Gobind Khorana is an American molecular biologist born on 9 January 1922 to an Indian Punjabi couple. For his work on the interpretation of the genetic code and its function in protein synthesis, he was awarded the Nobel Prize in the year 1968.

Raja Ramanna

Handpicked by the founder of India's nuclear program, Dr. Homi Bhabha, Dr. Raja Ramanna was a celebrated physicist and nuclear scientist that India had ever produced. A multifaceted personality, Dr. Raja Ramanna played the roles of a technologist, nuclear physicist, administrator, leader, musician, Sanskrit literature scholar, and philosophy researcher.

Ganapathi Thanikaimoni

Ganapathi Thanikaimoni, a successful botanist of his days, is remembered till date for his widespread contribution in the field of palynology. His researches and projects not only helped India to make its pres-