# Opportunities in STEM: Teaching and Research

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# What is STEM

## STEM Stands For:

- Science
- Technology
- Engineering
- Mathematics

**Science:** Science is a systematic study and investigation of natural phenomena and occurrences by way of observation, theoretical explanation as well as experimentation. Everything in the universe can be studied under the field of Science. Basically, Science can be divided into three broad subjects – Physics, Chemistry and Biology.

**Technology:** Technology is the skills, methods and processes used to achieve goals or in other words technology is the study and transformation of techniques, tools and machines created by humans and it allows humans to study and evolve the physical elements that are present in today's world.

**Engineering:** Engineering is the use of scientific principles to design and build machines, structures and other items including Bridges, Tunnels, Roads, Vehicles, Vaccines, GM Crops and Diagnostic Kits etc. It is a field which never ceases to grow. This field has a lot to offer to everyone who is willing to learn, innovate, design and want to build a strong foundation for a successful career.

**Mathematics:** Mathematics is an education in numeric sciences, using a range of different approaches including algebra, calculus and basic arithmetic. Mathematics is a key element of subjects ranging from Physics to Geology. Mathematics is applicable to nearly every industry, business, retail, healthcare, science and technology and much more.

# Girls Ratio in STEM Education

As per the report of UNESCO, only 35% of the STEM student in higher education are girls throughout the world. To overcome this gender gap, the participation of girls students in STEM education is the need of hour.

**STEM** education creates **critical** thinkers, increases science literacy, and enables the next generation of innovators. Innovation leads to new products and processes **that** sustain our economy. This innovation and science literacy depends on a solid knowledge base in the **STEM** areas. STEM subjects enable the girls students to think like a scientist and you all become a better problem solver.

# Scope for Girls in STEM Education

All STEM subjects are very important and is having a bright career ahead. In a broad way, the STEM is also comes under the umbrella of Science and Science is the most reputed and preferred stream among the students because it opens various lucrative career opportunities like Engineers, Doctors, Scientists, Dentists Pharmacists, Physiotherapists, Orthodontists, Professors, Teachers, Architects, Managers, Nurses, Designers, Computer Experts and many more.

# In the science stream, the students can choose two subject combinations as per their choices

- **1st - PCM – Physics + Chemistry + Mathematics- Engineering field**
- **2nd - PCB – Physics + Chemistry + Biology- Medical field**

**Medical Field Future Scope after 12th is as follows:**

- MBBS : Bachelor of Medicine and Bachelor of Surgery
- BDS: Bachelor in Dental Sciences
- B.V.Sc.: Bachelor in Veterinary sciences
- B.Pharma: Bachelor of Pharmacy
- B.Sc. Nursing: Bachelor in Nursing
- BPT: Bachelor in Physiotherapy
- BHMS: Bachelor in Homeopathic Medicinal Sciences
- BAMS: Bachelor in Ayurvedic Medicine and Surgery

# Types of courses after 12th

- B.Sc.
- M.Sc.
- B. Tech
- M. Tech
- Ph. D.
- Post Doc

Biotechnology, Microbiology, Bio-Chemistry, Botany, Zoology, Food Technology, Genetics, Forensic Sciences, Environmental Sciences, Bioinformatics, Chemistry (Organic, Inorganic, Physical), Physics, Mathematics, Nanotechnology and many more.

# Universities, Research and Educational Institutes

- Prestigious Institutions (IIT’s and NIT’s)
- Premier Institutions (IISc., TIFR, NISER & IISER)
- Research Council Labs (CSIR/ICMR/DBT/ICAR)
- Central Government Universities
- State Government Universities
- Govt. and Private Colleges
- R&D Industries (Govt. and Private)

# Council of Scientific and Industrial Research, Ministry of Science & Technology, Govt. of India

- CSIR-Central Building Research Institute(CSIR-CBRI), Roorkee
- CSIR-Centre for Cellular Molecular Biology(CSIR-CCMB), Hyderabad
- CSIR-Central Drug Research Institute(CSIR-CDRI), Lucknow
- CSIR-Central Electrochemical Research Institute(CSIR-CECRI), Karaikudi
- CSIR-Central Electronics Engineering Research Institute(CSIR-CEERI), Pilani
- CSIR-Central Institute of Medicinal Aromatic Plants(CSIR-CIMAP), Lucknow
- CSIR-Central Salt Marine Chemicals Research Institute(CSIR-CSMCRI), Bhavnagar
- CSIR-Institute of Genomics and Integrative Biology(CSIR-IGIB), Delhi
- CSIR-Institute of Microbial Technology(CSIR-IMTECH), Chandigarh
- CSIR-National Botanical Research Institute(CSIR-NBRI), Lucknow
- CSIR-Structural Engineering Research Centre(CSIR-SERC), Chennai

# Higher Education & Research

Different Science subjects like Chemistry, Physics and Biology have great scope of research. Biology is especially/predominantly a research based subject. We can do a valuable research by a interdisciplinary approach.

**Biology:** Biology is the study of anything that has life. It is a natural science concerned with the study of life and living organisms, including their structure, function, growth, origin, evolution, distribution, and taxonomy. Biology has many sub-categories like Botany, Zoology, Biotechnology, Microbiology, Genetics, Forensic and Bio-informatics etc.

**Physics:** Physics is the branch of science which deals with the study of nature & natural phenomenon. We also study the concept of energy and force in Physics. In broad way, it is general analysis of nature, conducted in order to better understand how the world and the universe behave.

- **Chemistry:** Chemistry is concerned with the composition, behavior, structure, and properties of matter, as well as the changes it undergoes during chemical reactions.
- After completing the PG in any of the courses like Biotechnology, Microbiology, Bio-chemistry, Botany, Zoology, Food Technology, Genetics, Forensic Sciences, Environmental Sciences, Bioinformatics, Chemistry, Physics, Nanotechnology, students can do Ph. D.
- If the students qualify the JRF (Junior Research Fellowship), they will get a stipend of ~Rs.31,000/- (for initial 2 years) and Rs. 35,000pm (for remaining tenure) by different Bodies like CSIR, UGC, DBT, DST, ICMR etc.
- Teaching positions- As per the UGC regulations- NET/SLET is the minimum eligibility for the recruitment of Assistant Professors in Universities and Colleges.

- **Human Resource Development Group, Council of Scientific & Industrial Research, CSIR-Research Grants (Research Fellowships & Associateships)**

- The EMR Division under HRD Group of Council of Scientific & Industrial Research (CSIR) provide CSIR Research Fellowships and Associateships to the students for research in University Departments/Institutes of National Importance/National Laboratories and Institutes of CSIR in various fields of Science & Technology and Medical Sciences under the supervision of faculty members/scientists.

- Department of Biotechnology (DBT), Ministry of Science and Technology, give a fellowship to meritorious students for pursuing research in Biotechnology through "DBT - JRF Programme".

# CSIR JUNIOR RESEARCH FELLOWSHIP (JRF)

- A large number of JRFs are awarded each year by CSIR to candidates holding BSc.(4)/BE/B. Tech/B. Pharma/MBBS/ Integrated M.Sc. or Equivalent degree/BSc (Hons.) or equivalent degree holders or students enrolled in integrated M.Sc.- Ph.D. program.
- JUNIOR RESEARCH FELLOWSHIP (JRF) is conducted by CSIR twice a year (June and December).
- Candidates with bachelor's degree, whether Science, Engineering or any other discipline, will be eligible for fellowship only after getting registered/enrolled for Ph.D/integrated Ph.D. programme within the validity period of two years.

# PG/Ph.D. in abroad

Pursuing M.Sc./Ph.D. in American/European countries may give you better international research exposure, skill sets and facilities depending on the type of University you choose.

The main destination for pursuing higher studies are USA, UK, Canada, Australia, New Zealand , Germany, France and other European Countries.

There are many Universities/Institutions with good ranking in these countries where you can go for doing your UG/PG/Ph.D. by adopting the due procedure for admission. The reputed institution are Oxford, Harvard, Stanford, Cambridge and Yale University, Caltech, MIT, Imperial College, London etc.

There are many scholarships offered by the various funding agencies/firms/companies to do higher studies in these foreign Universities/Institution.

# DST Programmes to inspire girl students in STEM

- The Vigyan Jyoti programme was launched by **DST** in 2019 to inspire **girl students** to pursue higher education and **career** in **STEM** fields by scholarship, visit to nearby scientific institutions, **science** camps, lecturers from eminent **women** scientists, and **career** counseling.

- Vigyan Prasar- ***Engage with Science***

- These opportunities are for meritorious girls to nurture their interest in Science, Technology, Engineering and Mathematics (STEM).

# Scope of Jobs

- **Research Institutes**
- **Central Government Universities**
- **State Government Universities**
- **Govt. and Private Colleges**
- **R&D Industries (Govt. and Private)**
- **Pharmaceutical companies-** Bharat Biotech, Serum Institute, Zydus Cadila, Panacea Biotech and many more.
- **Seed & Fertilizer Companies-** Monsanto, Bayer, Kaveri Seed Company Ltd., Krishak Bharati Cooperative Ltd. (KRIBHCO), Krishidhan Seeds Pvt Ltd., Maharashtra Hybrid Seeds Company Pvt Ltd (Mahyco), National Seeds Corporation Ltd., JK Agri Genetics Ltd. and many others.

# Fellowship after Ph. D. Degree

- **Start-Up Research Grant (Young Scientists) by Science and Engineering Research Board (SERB)**
  **There are** two schemes:
- Early Career Research Award (ECRA)
- National Post-Doctoral Fellowship (NPDF)
- **Scheme for Young Scientists and Technologists- This is to encourage the young researchers towards socio economic development by Department of Science and Technology(DST)**
- Dr. D.S. Kothari Post-Doctoral Fellowships in Sciences, Medical Sciences & Engineering Sciences
- Women Scientist Fellowship Scheme-The Department of Science & Technology (DST), Science for Equity, Empowerment & Development (SEED) Division has made tremendous efforts to promote the women researchers and scientists towards science and technology by initiating several schemes/fellowship programmes.

The objectives of this scheme are:

- To bring back the women scientists and technologists after a break in their careers.
- Provide platform and training to women scientists and technologists.
- Encourage women scientists and technologists to apply their S&T training towards innovative solutions to address various societal issues.

- **Indo-U.S. Genome Engineering/Editing Initiative (GETin) Overseas Fellowship**-It's a Fellowship Program for steering collaborative research projects between Indian institutes and premier U.S. Universities for students and young faculty in areas of Genome Engineering/ Editing Technology.

- **Indo-Japanese Joint Project on "Establishment of Young Researcher Fellowship Programme-**

- **Ramanujan Fellowship:** Ramanujan Fellowship is for the brilliant Indian scientists and engineers from outside India to take up scientific research positions in India.
- This is for the Indian scientists/engineers who want to return back to India.
- The amount of the Fellowship will be Rs. 1,35,000/- per month.

- **Kothari Fellowship:** Dr. D.S Kothari Postdoctral Fellowship Scheme is a post-doctral research fellowship scheme given by UGC to pursue an academic & research career by the young researchers.
- The amount of the fellowship will be approx. Rs. 50000/- per month

# THANK YOU