M.Tech. in Biomedical Engineering

CENTRE FOR BIOMEDICAL ENGINEERING
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About the Centre

Centre for Biomedical Engineering was established in 1971 as a Joint programme of Indian Institute of Technology, Delhi and All India Institute of Medical Sciences, Delhi. The Centre has applied engineering principles to address medical and biological problems. It has faculty from diverse backgrounds who are actively engaged in various interdisciplinary research activities. In addition, the centre has collaborative projects with major institutes and hospitals in India and abroad. Over the years, it has become a premier centre for biomedical research in the country and has provided interdisciplinary base to develop health care technologies. In the last two decades the focus has expanded to include biological medicine, development of innovative biomaterials, implants, biomedical devices, and informatics approaches for the prevention, diagnosis and treatment of diseases.

Research and Development

The Centre’s research focus spans in areas such as:

Bio-Instrumentation: Biosensor, Molecular markers in diseases, Lab-on-a-chip, Microfluidics, Biomedical transducers and sensors, Neuro endoscopy, Integrated healthcare, Assistive devices & rehabilitation, DNA based diagnostics.

Biomaterials: Nanomedicine, Controlled drug delivery systems, Soft skin regeneration, Brain and cancer targeting of bioactive molecules, Wound care healing, Tissue engineering, Medical diagnostics and therapy.

Biomechanics: Orthopaedics, Orthodontics, Computational analysis. Neuromechanics, Neural prosthetics.

Medical Imaging: MRI, CT, etc., Development of protocols, methods/models, techniques and software tools, Image processing, Quantitative image analysis.

Recently major facilities such as Confocal laser scanning microscope, Raman Spectroscopy with imaging and Flow cytometer has been installed. New labs based on drug delivery, laser micromachining, Lab-on-a-chip and image processing have been initiated.

International Collaborations

- Center has active collaborations with Universities in Germany, USA and Japan
- CBME has MoU with National Institute of Advanced Industrial Science and Technology (AIST), Japan and Bioelectronics Research Centre, Toyo University, Japan
- Center has initiated and successfully running DBT sponsored Stanford-India Biodesign program (now School of International Biodesign) in collaboration with AIIMS, New Delhi
About the Masters Programme

With rapid increase in disease burden and associated healthcare costs in almost every country, there is an immediate need for large scale investment in establishing quality education centres to train manpower for biomedical industry. Without the trained manpower, required biomedical research and development can not succeed to bring consistent innovation in development of cost-effective and reliable healthcare products.

M.Tech. programme in Biomedical Engineering is designed for students from both engineering and science disciplines to give training in frontier areas for solving the longstanding problems of healthcare. The course shall initiate induction of 20 students per year across various disciplines of study. The students shall also be drawn from industry, as public-private collaboration is essential for the successful translation of biomedical research and development.

As the course is highly multidisciplinary in nature, the students shall be provided with basic knowledge across biology, chemistry, mathematics, clinical science and engineering in the initial semester and in the final semesters they shall undertake research project in their area of interest. While designing the curriculum, we have ensured that along with developing a strong base in biomedical engineering through well designed multidisciplinary courses, the students get the opportunity to expand their creativity, independent thinking and problem solving aptitude via extensive laboratory exposure.

Requirements for Admission

Students of different academic backgrounds will be admitted through written test and interview. All students admitted in this programme will be governed by the Institute rules and regulations. The student must meet the general Institute requirements for M. Tech. degree as well as the Center’s requirements and must complete the program approved by the student’s advisor.

The general guidelines for admission are:

- Fulfilling the minimum eligibility criteria as per Institute norms.
- B.Tech./B.E. in Biomedical, Chemical, Computer Science, Electrical, Electronics and Communications, Instrumentation and Mechanical Engineering, Engineering Physics, Biochemical Engineering and Biotechnology, Materials Science, & Technology OR
- M.Sc. or equivalent in Biotechnology, Chemistry, Electronics, Materials Science, Mathematics, Polymer Science and Technology, Physics OR
- M.B.B.S or B.D.S
- B.Pharm. (duration 4 years and more)
- The entrance examination criteria for bachelors in Medicine and Dental Sciences shall be either GATE (if available) or other GATE equivalent national examinations. In other disciplines, requirement of a GATE score shall be as per institute norms.
- Students admitted to this programme under sponsored category are expected to have their own source of funding.

Prospects after the Degree

After the successful completion of the program, we envision that our graduates will have variety of career options, including:

- Research & development personnel in healthcare, pharmaceutical, biotech and medical device industry
- Evaluating new medical technologies for venture capital firms
- Initiating start-up companies in various areas of Biomedical Engineering
- Pursuing academic research and teaching in Biomedical Science & Engineering
- Hospitals, diagnostic labs and other healthcare facilities
**M. Tech Programme Description**

M.Tech. programme will comprise of a minimum of 50 Credits, of which the distribution of credit shall be as per the following table:

<table>
<thead>
<tr>
<th>Category</th>
<th>橋樑課程 (BC)</th>
<th>核心課程 (PC)</th>
<th>終期實習 (PE)</th>
<th>總計</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credits</td>
<td>02</td>
<td>18</td>
<td>21</td>
<td>53</td>
</tr>
</tbody>
</table>

**Bridge Courses (Core) (BC)**
- Basic Electronics
- Basic Mathematics for Biologists
- Basic Biology & Physiology
- Mechanics of Biomaterials

**Program Core (PC)**
- Fundamentals of Biomechanics
- Industrial Biomaterial Technology
- Medical Imaging
- Application of Mathematics in Biomedical Engineering
- Ethics, Safety and Regulatory Affairs
- Biomedical Instrumentation
- Basic Biomedical Laboratory
- Major Project - 1
- Major Project – 2

**Program Electives (PE)**
- Nanomedicine
- Biomaterials
- Tissue Engineering
- Medical Device Design
- Modern Medicine: An Engineering Perspective
- Biomedical Image and Signal Processing
- Cancer: Diagnosis and Therapy
- Biosensor Technology
- Point-of-Care-Medical Diagnostic Devices
- Orthopaedic Device Design
- Biofabrication
- Research techniques in Biomedical Engineering

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**Laboratory Facilities**

<table>
<thead>
<tr>
<th>Bioelectronics &amp; Bioinstrumentation</th>
<th>Biomaterials</th>
<th>Medical Image Processing</th>
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</thead>
<tbody>
<tr>
<td>Biomechanics</td>
<td>Bio-signal Processing</td>
<td>Bio-therapeutics</td>
</tr>
<tr>
<td>Animal Cell Culture</td>
<td>Molecular Biology</td>
<td>Biomaterials Instrumentation</td>
</tr>
<tr>
<td>Nanomaterial Synthesis</td>
<td>Lab-on-Chip &amp; Biosensors</td>
<td>Pre-clinical &amp; Animal Experimentation (AIIMS)</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Soft Tissue Engineering</td>
<td>Drug Delivery</td>
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Faculty

Veena Koul
Professor & Head
Ph.D. (Kashmir Univ.)
Medical Devices, Drug/Gene Delivery Systems, Biomaterials, Nanomedicine.

Harpal Singh
Professor
Ph.D. (IIT Delhi)
Medical Diagnostics, Drug Delivery Systems, Medical Devices, Nanobiotechnology.

S. M. K. Rahman
Assistant Professor
Ph.D. (MNIT, Allahabad)
Embedded Systems, Medical Electronics, Digital Hardware Design.

Sandeep Kumar Jha
Assistant Professor
Ph.D. (BARC, Mumbai)
Biosensors, Microfluidic, Lab-on-Chip, Capillary Electrophoresis Microchip.

Dinesh Kalyanasundaram
Assistant Professor
Ph.D. (Iowa State Univ., USA)

Anup Singh
Assistant Professor
Ph.D. (IIT Kanpur)
Medical Imaging, MRI Methods & Techniques, Image Processing, Quantitative Analysis.

Neetu Singh
Assistant Professor
Ph.D. (Georgia Tech, USA)
Nanomedicine, Bioimaging, Biomedical Implants, Cancer Diagnostics, Drug Delivery, Tissue Engineering.

Amit Mehndiratta
Assistant Professor
D.Phil. (Oxford, UK)
Biomedical Imaging, Image Processing, Quantitative Image Analysis, Mobile Assisted Healthcare.

Deepak Joshi
Assistant Professor
Ph.D. (IIT Delhi)
Biomedical Instrumentation, Rehabilitation Engineering.

Jayanta Bhattacharyya
Assistant Professor
Ph.D. (IICT, Hyderabad)
Biomaterials, Drug Delivery, Cancer diagnosis & Therapy.

Sneh Anand
Professor Emeritus
Ph.D. (IIT Delhi)
Biomedical Instrumentation, Rehabilitation Engineering.