

Department of Biosciences and Bioengineering

M. Tech. in Biomedical Engineering (BME)

Introduction

Biomedical Engineering (BME), an interdisciplinary field, has made tremendous progress in the last several decades. In the field of Biomedical Engineering, researchers with expertise in diverse areas of engineering, physical sciences, life sciences, and medicine work towards the goal of creating new knowledge, products, and techniques for better healthcare. The backgrounds of faculty in BME at IIT Bombay reflects the wide spectrum of expertise required to make better and more affordable healthcare a reality. Further, students admitted to the program have backgrounds in engineering, physical sciences, life sciences, and health sciences, making it one of the unique programs in the country to offer M. Tech. admission to such a varied mix of candidates. The creation of a heterogeneous class composition promotes interaction between students and faculty of different backgrounds and provides opportunities for research in exciting interdisciplinary areas.

Course work & project

Over the first two semesters, M. Tech. students are required to do a substantial amount of course work to complement their undergraduate or masters level education. The third semester is devoted mostly to the M.Tech. project although some courses may be taken during that period. The fourth semester is fully devoted to completion of the project. The curriculum has been designed to provide all students with a general background in Biomedical Engineering followed by more specific knowledge in the area of their choice. The former is achieved through core (for everyone) and compulsory/soft core (for students with a particular background) courses in the first semester. Electives taken during the second and third semester can provide specialized knowledge in the areas of individual interest.

In the first semester, students with backgrounds in life sciences and medicine are required to take a compulsory course in mathematics. Students with backgrounds in physical sciences and engineering take courses in physiology. There are other core and elective courses to be taken as well.

In the second semester, all students have to go through a core course on Biostatistics. Further, everyone is required to take a credit seminar course and present a seminar on a topic related to Biomedical Engineering under the guidance of a faculty. The rest of the courses are electives, which the students choose and may consult with the faculty adviser.

Electives are offered in biomedical engineering, bio-nanotechnology, biomedical microsystems, biopotentials, elements of circuits and instrumentations, biomechanics, medical sensors, signals and systems, medical imaging physics, biomaterials, drug delivery, cellular & tissue engineering, microfluidics, biomedical optics, movement neuroscience, surgical reconstruction, etc.

All students are also required to take a course designated as an Institute Elective offered by an academic unit other than Biosciences and Bioengineering. In special cases, courses other than the Institute Elective may be taken after obtaining necessary permission from the Department Post Graduate Committee (DPGC).

Research areas

Currently curiosity-driven and translational research are conducted in a range of interdisciplinary domains and students may choose to do projects in any of these domains. The details about the different research areas and labs can be found on the department website, given below:

<https://www.bio.iitb.ac.in/research/research-areas/>

MTech Course Curriculum

1st Semester

Core courses (4 Credits)

| Code | Subject name | L | T | P | C | Instructor(s) | For AY 2024-25 |
|--------|---|---|---|---|----|--|----------------|
| BB 600 | Introduction to Biomedical Engineering | 3 | 0 | 0 | 6 | HV | Offered |
| BB 653 | Experimental techniques in biomedical engineering | 1 | 0 | 2 | 4 | HV*, DPaul, AKun, NT | Offered |
| BB 899 | Communication skills (PP/NP (*Credits over and above the required minimum of 160) | 1 | 2 | 0 | 6* | SN*, PVB (2 h), RPat (2 weeks), Akun (3 lectures), SRS | Offered |

Soft Core Courses (Compulsory courses based on background) (6 credits)

| Code | Subject name | L | T | P | C | Instructor(s) | For AY 2024-25 |
|--------------------------------------|----------------------------|---|---|---|---|---------------|----------------|
| For Bio. background students | | | | | | | |
| BB 619 | Mathematics for biologists | 2 | 1 | 0 | 6 | SandipK | Offered |
| For Engg. background students | | | | | | | |
| BB 603 | Physiology for engineers | 3 | 0 | 0 | 6 | NT*, VPS | Offered |

Department Electives (18-24 credits to be completed over the first semester: extra credits may be tagged as additional learning)

FH: runs in First Half of the semester, SH: runs in Second Half of the semester

Note: M. Tech. students can take 3-4 half-semester courses in FH (9-12 credits) and 3-4 half-semester courses in SH (9-12 credits).

| Code | Subject name | L | T | P | C | Instructor(s) | For AY 2024-25 |
|-------------|---|----------|----------|----------|----------|----------------------|-----------------------|
| BB 633 (FH) | Movement neuroscience | 3 | 0 | 0 | 3 | NK | Offered |
| BB 661 (FH) | Biopotentials I: Cellular Signals | 3 | 0 | 0 | 3 | RManch | Offered |
| BB 663 (FH) | Medical imaging physics | 3 | 0 | 0 | 3 | DPaul | Offered |
| BB 669 (FH) | Signals & systems in biomedical engineering | 3 | 0 | 0 | 3 | Akun | Offered |
| BB 601 (SH) | Introduction to bio-nanotechnology | 3 | 0 | 0 | 3 | RS | Offered |
| BM 659 (SH) | Elements of circuits and instrumentation | 3 | 0 | 0 | 3 | AKun | Offered |
| BB 677 (SH) | Introduction to Biomechanics | 3 | 0 | 0 | 3 | SSen | Offered |

2nd Semester

Core Courses (10 Credits)

| Code | Subject name | L | T | P | C | Proposed instructor | For AY 2024-25 |
|-------------|---------------------|----------|----------|----------|----------|----------------------------|-----------------------|
| BB 621 | Biostatistics | 3 | 0 | 0 | 6 | AKun | Offered |
| BB 694 | Credit seminar# | 0 | 0 | 0 | 4 | SSen | Offered |

Department Electives (24-18 credits to be completed over the second semester: extra credits may be tagged as additional learning)

FH: runs in First Half of the semester, SH: runs in Second Half of the semester

| Code | Subject Name | L | T | P | C | Proposed instructor | For AY 2024-25 |
|-------------|---|----------|----------|----------|----------|----------------------------|-----------------------|
| BB 606 | Cellular electricity: physics & modeling | 3 | 0 | 0 | 6 | RM | Offered |
| BB 610 | Biomedical microsystems | 3 | 0 | 0 | 6 | RS | Offered |
| BB 612 | Cell mechanics and mechanobiology | 3 | 0 | 0 | 6 | SSen | Offered |
| BB 624 | Microfluidics: physics and applications | 3 | 0 | 0 | 6 | DPaul | Offered |
| BB 625 | Motor control in health and disease | 3 | 0 | 0 | 6 | NK | Offered |
| BB 626 | Modeling Biological Systems and Processes | 3 | 0 | 0 | 6 | RP | Offered |
| BB 655 | Introduction to biomedical optics | 3 | 0 | 0 | 6 | HV | Offered |
| BB 667 | Computational Physiology and Medicine | 2 | 1 | 0 | 6 | DA | Offered |
| BB 668 | Engineering Principles in Surgical Reconstruction | 1 | 0 | 4 | 6 | VPS*, AKun | Offered |

3rd Semester

Institute Elective (6 credits)

| Code | Subject Name | L | T | P | C |
|-------------|--|----------|----------|----------|----------|
| | Institute elective (to be taken in the 3rd semester) | 3 | 0 | 0 | 6 |

MTP Stage 1- Contact hours: 0; Credits: 44

| Code | Subject Name | L | T | P | C |
|-------------|---------------------|----------|----------|----------|----------|
| BB 797 | Project Stage I # | 0 | 0 | 0 | 44 |

The department process for allotting Credit Seminar and MTP topics to students: **click here**

4th Semester

MTP Stage 2- Contact hours: 0; Credits: 48

| Code | Subject Name | L | T | P | C |
|-------------|---------------------|----------|----------|----------|----------|
| BB 798 | Project Stage II | 0 | 0 | 0 | 48 |

Course Work and Credit Structure

| Course work and Credits | Sem. 1 | Sem. 2 | Sem. 3 | Sem. 4 | Total |
|--|--------|--------|--------|--------|-------|
| Core course (BB653: Experimental Techniques in Biomedical Engineering; Lab course) | 10 | – | – | – | 10 |
| Core course (BB621: Biostatistics + BB694: Credit Seminar) | – | 10 | – | – | 10 |
| Soft core courses (One compulsory course based on background) | 6 | – | – | – | 6 |
| Department electives | 12-18 | 24-18 | – | – | 36 |
| Institute elective | – | – | 6 | – | 6 |
| Communication skills | PP/NP | – | – | – | PP/NP |
| Total course credits (A) | 28-34 | 34-28 | 6 | – | 68 |
| M. Tech. project credits (B) | – | – | 44 | 48 | 92 |
| Total credits for the program (A+B) | | | | | 160 |

Note : Other than the courses listed above (i.e. Core course, Soft core, Department Elective and Institute Elective), any other course (within or outside department) can be taken as Additional Learning.

Course syllabus:

The syllabi for courses offered by the BSBE department can be found at:

<https://www.bio.iitb.ac.in/academics/mtech-program/mtech-course-curriculum/>

Note: In addition to the above, the course instructor may be contacted for any further details.