

# **Course Curriculum**

*For*

**B. Tech. (Mechanical Engineering)**



**Department of Mechanical Engineering  
National Institute of Technology Delhi**

**w.e.f. the Academic Year  
2022-2023**

# **Department of Mechanical Engineering National Institute of Technology Delhi**

## **1.1 About the Department**

Welcome to the Department of Mechanical Engineering at NIT Delhi. Mechanical Engineering is a diverse field, which involves design, analysis and manufacturing from small machine parts and devices to large systems. We aspire to have a distinguished tradition of excellence in the theme areas ranging from thermal, mechanics, design and manufacturing to CAD/CAM/CAE. Department is committed to disseminate the advanced engineering education and pursues success in research as well. Department is dedicated to preparing students to face the emerging challenges facing by society. The department currently runs one undergraduate program B. Tech. (Mechanical Engineering) and one master's program M. Tech. (CAD/CAM). Ph. D. program is also offered by the Department in all area of the Mechanical Engineering since Academic year 2016-2017. The Department is currently equipped with CAD Laboratory. Intake for M. Tech. CAD/CAM program is 34 seats + 2 seats (through DASA) including GATE scholarship, self-financed & sponsored seats. The program has been started from academic session 2016-17.

The Department's dream is to translate its research and to develop teaching methods so that the underprivileged minds can find technological solutions to future challenges. Students also have the opportunity to work with professionals from various fields in emerging areas such as Internet of Things (IoT), Machine Learning (ML), Smart Healthcare, and Artificial Intelligence (AI), Digital Manufacturing, Mechatronics etc. Currently, Department of Mechanical Engineering has four (04) regular faculties with few faculties expected to join this year. Faculty members of the department have excellent academic & research credentials and published numerous peer reviewed journal articles/papers, Books, Book Chapters etc. in diversified field and having adequate experience in advanced research. The Department believes that by developing a culture of seeking for knowledge and dissemination of research findings, intellectually sound, self-motivated and reliant mechanical engineers and researchers, who will be the bedrock of our nation's march towards qualitative and massive technological development and dynamic industrialization, will be actualized. In other words, the department hopes to achieve the national goals and objectives of industrialization and self-reliance. As a result, it hopes to produce graduates with strong academic and practical background so that they can fit into the industry immediately upon graduation.

## **1.2 Vision**

To be a global knowledge hub in mechanical engineering education, research, entrepreneurship and industry outreach services.

## **1.3 Mission**

- Impart quality education and training to nurture globally competitive mechanical engineers.
- Provide vital state-of-the-art research facilities to create, interpret, apply and disseminate knowledge.
- Develop linkages with world class educational institutions and R&D organizations for excellence in teaching, research and consultancy services.

## **B. Tech. (Mechanical Engineering)**

### **2.1 Preamble**

**B. Tech. (Mechanical Engineering)** program offered at NIT Delhi is designed to equip students with a unique blend of skill sets that include:

- Strong theoretical foundation
- Predominantly practice-oriented approach with access to well-equipped and specialized laboratories, and supervised internship via the Practice School
- Hands-on technical training
- Life skills orientation
- Hard and soft skills
- Business perspective, along with emphasis on innovation and entrepreneurship
- Specialized courses in advanced areas such as Robotics, Mechatronics, Biomechanics, etc.

### **2.2 Salient Features:**

- Minimum Credits requirements for completion of BTech program is 160.
- The Curriculum is based on the guidelines of National Education Policy (NEP) – 2020.
- The curriculum has embedded the Multi Exit/ Multi Entry in the BTech program.
- There is provision of Major degree and Minor Degree for students.
- The curriculum is designed to meet the prevailing and ongoing industrial requirements.
- The curriculum includes Project based Education with Projects every year.
- The curriculum is flexible and offers Choice Based Credit System (CBCS).
- The curriculum inherits the Value based Education and offers Interdisciplinary/ Multidisciplinary Courses.
- The Curriculum offers Digital Pedagogy & Flipped Learning with adequate motivation for Entrepreneurship/ Startups.
- The curriculum aims the Holistic Development of the students.

### **2.3 Cardinal Mentions:**

- ✓ Students exiting after completing 1<sup>st</sup> Year, 2<sup>nd</sup> Year and 3<sup>rd</sup> Year will be awarded Certificate, Diploma and Advanced Diploma in Mechanical Engineering respectively. A minimum Credit requirement for Certificate is 40 Credits, Diploma is 80 Credits and Advanced Diploma is 120 Credits respectively.
- ✓ The students can opt for Minor Degree across any specialization offered in the Institute from 5<sup>th</sup> Semester e.g. a student pursuing B. Tech. (Mechanical Engineering) may opt for Minor Degrees like Artificial Intelligence, Machine Learning, Data Sciences, Communication, VLSI etc. offered by the different Departments in the Institute depending upon his interest.
- ✓ The students opting for Minor Degree will have to earn addition credits for the Minor Degree as per Institute norms from time to time.

### Program Educational Objectives (PEOs)

<b>PEO-1</b>	Analyze the complex systems with the help of design engineering, thermal engineering, manufacturing and allied engineering concepts by applying mathematics and sciences.
<b>PEO-2</b>	Demonstrate multi-disciplinary knowledge and skills to analyze, interpret and create solutions to the real-life mechanical engineering problems.
<b>PEO-3</b>	Embrace capability to expand horizons beyond engineering for creativity, innovation and entrepreneurship.
<b>PEO-4</b>	Imbibe competence and ethics for social and environmental sustainability with a focus on the welfare of humankind.

### Program Outcomes (POs) of B. Tech (Mechanical Engineering)

<b>PO-1</b>	<b>Engineering Knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO-2</b>	<b>Problem Analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO-3</b>	<b>Design/Development of Solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
<b>PO-4</b>	<b>Conduct Investigations of Complex Problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO-5</b>	<b>Modern Tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
<b>PO-6</b>	<b>The Engineer and Society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
<b>PO-7</b>	<b>Environment and Sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO-8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO-9</b>	<b>Individual and Team Work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

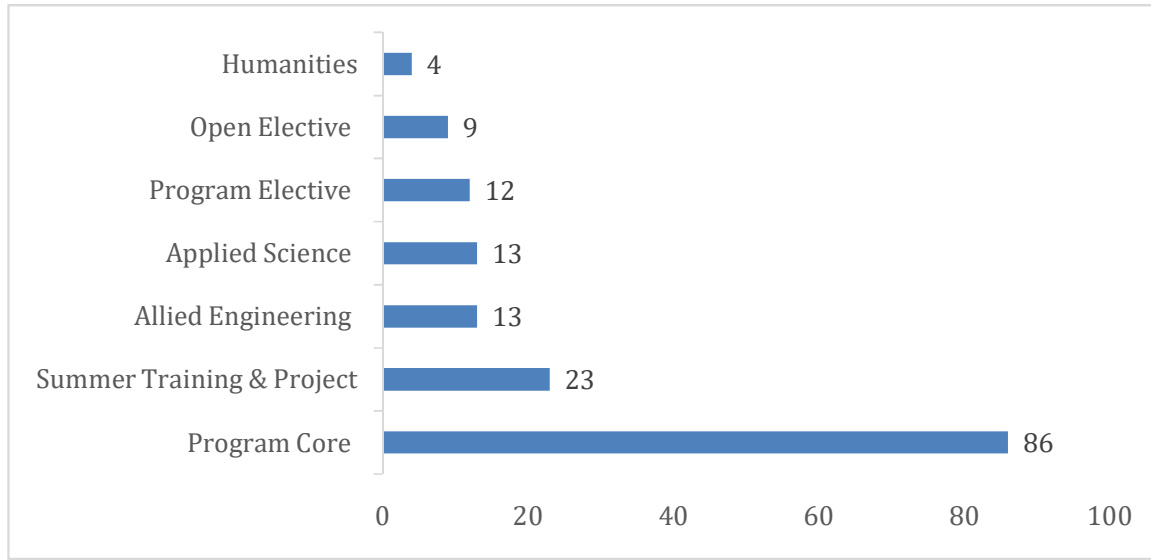
<b>PO-10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO-11</b>	<b>Project Management and Finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO-12</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### **Program Specific Objectives (PSOs)**

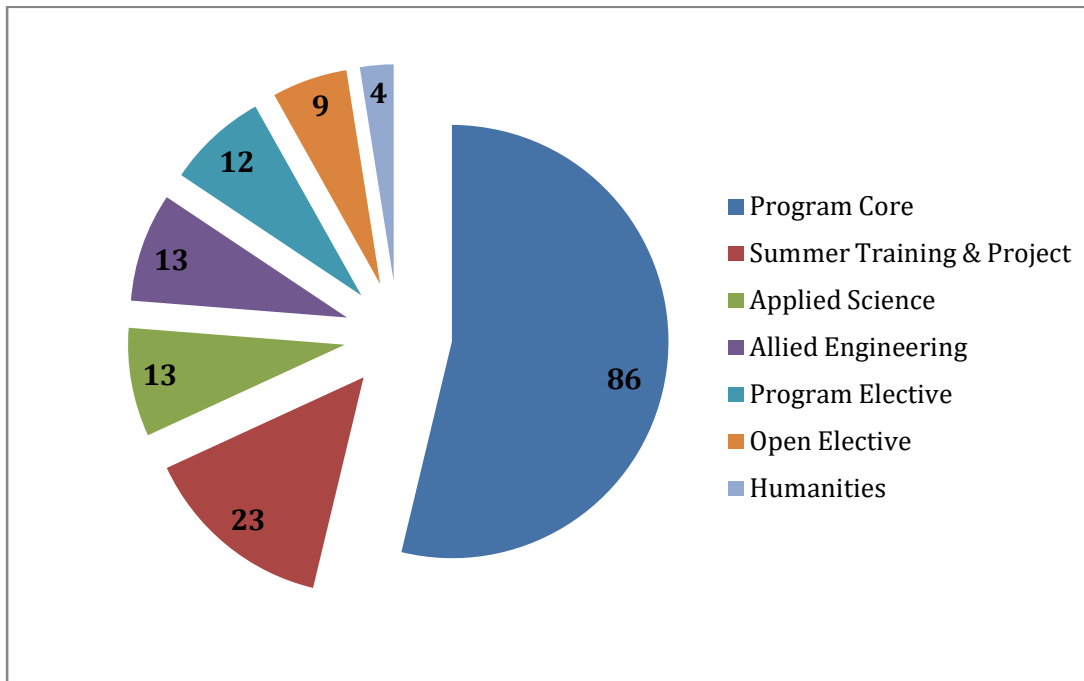
<b>PSO -1</b>	Students will be able to analyze, interpret and provide solutions to the advanced software tools for design real life mechanical engineering problems.
<b>PSO -2</b>	Students will gain team spirit for working in variety industries like 3-D printing, Additive Manufacturing, HVAC, Aviation, and Automobile & Power Sectors.
<b>PSO -3</b>	Students will be able to pursue higher studies for contribution to research and development as well as participate in Entrepreneurs.



## I. Credit Distribution among Different Courses Categories



## II. Percentage (%) Credit Distribution among Different Courses Categories



### III. Course Scheme of B. Tech (Mechanical Engineering)

#### SEMESTER – I

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MAL 101	Engineering Mathematics-I	3	3	3	0	0	3
2	PHB 111	Engineering Physics	3+1	4	3	0	2	4
3	MEB 111	Introduction to Manufacturing Technology	3+1	4	3	0	2	4
4	HML 101	Communication Skills	2	2	2	0	0	2
5	CSB 111	Computer Programming	2+1	3	2	0	2	3
6	MEL 101	Introduction to Sensors, Actuators & IoT	2	2	2	0	0	2
7	MEP 122	Joy of Engineering	1	1	0	0	2	1
8	EVP 101	Nature and Care	1	0	0	0	2	1
		<b>Total</b>	<b>15+5</b>	<b>20</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>20</b>

#### SEMESTER – II

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MEB 161	Engineering Materials	3+1	4	3	0	2	4
2	MEL 151	Engineering Mechanics	3	3	3	0	0	3
3	MEB 162	Engineering Visualization	3+1	4	3	0	2	4
4	EEB 161	Introduction to Electrical & Electronics Engineering	3+1	4	3	0	2	4
5	EVL 151	Environment Sciences	2	2	2	0	0	2
6	HMP 171	Technical Report Writing	1	1	0	0	2	1
7	MEP 171	Project	2	2	0	0	0	2
		<b>Total</b>	<b>14+6</b>	<b>20</b>	<b>14</b>	<b>0</b>	<b>8</b>	<b>20</b>

**NOTE:** Summer Training (6-8 Weeks) is mandatory for each student to continue the program and their evaluation will be done in the Semester-III.



**SEMESTER – III**

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MAL 201	Engineering Mathematics-II	3	3	3	0	0	3
2	MEB 211	Fluid Mechanics	3+1	4	3	0	2	4
3	MEL 201	Engineering Thermodynamics	3	3	3	0	0	3
4	MEL 202	Mechanics of Materials	3	3	3	0	0	3
5	MEP221	Computer Aided Drawing	1	1	0	0	2	1
6	MEP 222	Programming with Python	1	1	0	0	2	1
7	MEB 212	Manufacturing Sciences-I	3+1	4	3	0	2	4
8	MEP 223	Summer Training- I	1	1	0	0	0	1
	<b>Total</b>		<b>15+5</b>	<b>20</b>	<b>15</b>	<b>0</b>	<b>8</b>	<b>20</b>

**SEMESTER – IV**

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MEB 261	Kinematics & Dynamics of Machines	3+1	4	3	0	2	4
2	MEB 262	Heat and Mass Transfer	3+1	4	3	0	2	4
3	MEB 263	Engineering Metrology & Instrumentation	2+1	3	2	0	2	3
4	MEL 251	Manufacturing Sciences-II	3	3	3	0	0	3
5	MEL 252	Design of Machine Elements	3	3	3	0	0	3
6	MEP 271	Programming with MATLAB	1	1	0	0	2	1
7	MEP272	Project	2	2	0	0	0	2
	<b>Total</b>		<b>14+6</b>	<b>20</b>	<b>14</b>	<b>0</b>	<b>6</b>	<b>20</b>

**NOTE:** Summer Training (6-8 Weeks) is mandatory for each student to continue the program and their evaluation will be done in the Semester-V.

**SEMESTER – V**

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MEB 311	IC Engines & Gas Turbines	3+1	4	3	0	2	4
2	MEB 312	Fluid Machinery	3+1	4	3	0	2	4
3	MEB 313	Computer Aided Design	3+1	4	3	0	2	4
4	MEB 314	Industrial Engineering	3+1	4	3	0	2	4
5	EEB 311	Control Systems & Engineering	3	3	3	0	0	3
6	MEP 321	Summer Training- II	1	1	0	0	0	1
	<b>Total</b>		<b>15+5</b>	<b>20</b>	<b>15</b>	<b>0</b>	<b>8</b>	<b>20</b>

**SEMESTER – VI**

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MEL 351	Optimization & Simulation in Engineering Applications	3	3	3	0	0	3
2	MEB 361	Manufacturing Automation & Robotics	3+1	4	3	0	2	4
3	MEB 362	Mechatronics Engineering	3+1	4	3	0	0	4
4	MEB 363	Heating, Ventilation & Air conditioning (HVAC)	3+1	4	3	0	2	4
5	MEL 38X	Program Elective-1	3	3	2	0	0	3
6	MEP 371	Project	2	2	0	0	0	2
	<b>Total</b>		<b>15+5</b>	<b>20</b>	<b>15</b>	<b>0</b>	<b>4</b>	<b>20</b>

**NOTE:** Summer Training (6 - 8 Weeks) is mandatory for each student to continue the program and their evaluation will be done in the Semester-VII.

**SEMESTER –VII**

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MEL 401	Additive Manufacturing	3	3	3	0	0	3
2	CSL 40X	Artificial Intelligence & Machine Learning	3	3	3	0	0	3
3	MEL 43X	Program Elective-2	3	3	3	0	0	3
4	MEL 43X	Program Elective-3	3	3	3	0	0	3
5	XXXXXX	Open Elective-1	3	3	3	0	0	3
6	XXXXXX	Open Elective-2	3	3	3	0	0	3
7	MEP 421	Seminar	1	1	0	0	4	1
8	MEP 422	Summer Training – III	1	1	0	0	0	1
	<b>Total</b>		<b>18+2</b>	<b>20</b>	<b>18</b>	<b>0</b>	<b>4</b>	<b>20</b>

**SEMESTER – VIII**

Sl. No.	Course Code	Course Name	Credits		L	T	P	C
1	MEL48X	MOOCs (Program Elective-4)	3	3	3	0	0	3
2	XXXXXX	MOOCs (Open Elective-3)	3	3	3	0	0	3
3	MEP471	Project Report	14	14	0	0	0	14
	<b>Total</b>		<b>6+14</b>	<b>20</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>20</b>

**NOTE:** MOOC's courses approved by Department only be studied by the students.

**IV. B.Tech (Mechanical Engineering): Tentative Program Elective Courses**

<b>Stream</b>	<b>Program Elective-1</b>	<b>Program Elective-2</b>	<b>Program Elective-3</b>
<b>Manufacturing</b>	Quality Management Systems & Accreditations	Mathematical Modeling of Manufacturing Processes	Mechanical Behavior & Testing of Materials
	Smart Materials&Structures	Mechanics of Composite Materials	Computer Integrated Manufacturing
	Product Design & Development	Flexible Manufacturing Systems	Digital Manufacturing
	Micro and Nano Manufacturing	Theory of Metal Cutting	Design and Analysis of Management Information Systems
<b>Design</b>	Fracture Mechanics	Dynamics of Mechanical Systems	Engineering Tribology
	MEMS Devices – Design and Fabrication	Advanced FEM	Human Factors in Engineering and Design
	Vibration and Noise	Theory of Elasticity	
<b>Thermal</b>	Power Plant Engineering	Hybrid and Electrical Vehicles	Alternate Fuels for IC Engines
	Applied Thermodynamics	Solar Thermal Processes	Vehicular Pollution
	Non-Conventional Energy Resources	Computational Fluid Dynamics	Combustion Generated Pollution & Control

\*The List of program Electives offered by the Department is tentative and will be reviewed on yearly basis and depending upon the requirements of the Industry/ Availability of faculties, the program electives will be offered. \*\*The Open Electives will be selected by the students from the Electives offered by Other Department for their BTech programs.

**V. B.Tech (Mechanical Engineering): Tentative Open Elective Courses**

- Open Elective Courses will be taken by the concerned Departments.

**VI. B.Tech. (Mechanical Engineering): Tentative MOOC Courses**

<b>MOOCs (Program Elective-4)</b>	<b>MOOCs (Open Elective-3)</b>
<ul style="list-style-type: none"><li>• Quality Control in Manufacturing</li></ul>	<ul style="list-style-type: none"><li>• Data Science</li></ul>
<ul style="list-style-type: none"><li>• Aerodynamics</li></ul>	<ul style="list-style-type: none"><li>• Internet of Things</li></ul>
<ul style="list-style-type: none"><li>• Robotics</li></ul>	<ul style="list-style-type: none"><li>• Information and Communication Technologies (ICT)</li></ul>
<ul style="list-style-type: none"><li>• Thermodynamics of Cryogenic System</li></ul>	<ul style="list-style-type: none"><li>• Introduction to Game Development</li></ul>
<ul style="list-style-type: none"><li>• Physics of Turbulent Flow</li></ul>	<ul style="list-style-type: none"><li>• Importance of Safety</li></ul>
<ul style="list-style-type: none"><li>• Industry 4.0</li></ul>	<ul style="list-style-type: none"><li>• Industrial Internet of Things (IIoT)</li></ul>