2021 Bachelor of Technology in Mechanical Engineering

I. About Mechanical Engineering

Mechanical engineering is one of the most adaptable and versatile disciplines of engineering. The principles of Mechanical Engineering are applicable to the design and development of products ranging from cell phones to aircrafts to bio-implants. Mechanical engineering graduates find relevance in industries such as aerospace, automotive, advanced manufacturing, thermal and energy systems and advanced materials. In addition, mechanical engineers are very well placed to understand the economics of product development and manufacturing and are very well suited to entrepreneurship.

II. About the Program and the Department of Mechanical Engineering

The program of Mechanical Engineering was one of the four engineering programs started at the inception of Mahindra Ecole Centrale (now Ecole Centrale School of Engineering, Mahindra University). The research interests of the faculty of Mechanical engineering span diverse areas such as Metamaterials, Microfluidics, Dynamic fracture, Earthquake dynamics, Advanced and Smart materials, Solar energy, Multiphysics and Multiscale processes, Robotics design, Combustion and Advanced manufacturing. The department executes its mission with a focus on enhanced student-teacher interaction and collaboration for research and product development.

Vision:

To attain the highest standards of excellence in technical pedagogy, contribution to contemporary research and nurture an entrepreneurial spirit that fosters leadership in technological innovations and create future ready global citizens.

Mission:

1. Promote a culture of excellence in fundamental research and collaboration with industry, enabling continual intellectual growth of faculty and help students reach their potential.
2. Offer a holistic and interdisciplinary education that combines knowledge from core principles of Mechanical and allied engineering disciplines, with humanities, ethics and management.
3. Encourage collaboration among students to better apply their technical training and innovate solutions to complex technical problems.

The Department of Mechanical Engineering offers a four-year program towards earning a bachelor's degree. The curriculum builds on the fundamentals of Mathematics and sciences built in high school and extends them to applications related to Mechanical Engineering such as Thermodynamics, Solid and fluid Mechanics, Heat transfer, Instrumentation and Control systems, Materials, Mechanisms and machines and Manufacturing processes. In addition, programming literacy is ensured by preliminary and advanced courses in programming and data structures. Courses related to promising and emerging areas such as Robotics are also part of the curriculum.

The curriculum also includes courses in Humanities, Economics and Ethics to provide students a holistic perspective. In combination with the above, the Design thinking course prepares the students to develop solutions that empathize with all the stakeholders for a problem. Practical learning is incorporated into the program by way of labs, measurement and instrumentation and systems engineering project in the third year and the final year project. Additionally, students need to finish an internship program for one summer and are strongly encouraged to spend the last semester of the program as interns and address scientific problems.

During the second half of the program, the students may choose to specialize in anyone of four streams that address:

1. Materials and Mechanics
2. Energy systems
3. Transportation/ Mobility
4. Mechatronics

III. Program Outcomes

The curriculum of the four year degree program is designed to expose the student to incrementally complex concepts and applications. The majority of the first three semesters is spent in establishing sound fundamentals in mathematics, sciences and programming. The core mechanical engineering curriculum starts in the fourth semester establishing the basic principles of mechanical engineering. The majority of the fundamental courses of mechanical engineering is completed by the sixth semester and is intended to form a basis for the student to tackle a significant problem during the final year project. The selection of a stream is expected to address specific interests of the students and serve to educate the student on current and future technologies while also preparing them for higher studies. By the end of the program, the graduates are expected to have a strong understanding of the basic principles of mechanical engineering as applied from sciences, and apply these principles to design and develop solutions or systems to tackle problems of interest. The specific outcomes expected of graduates of the program are

1. Analyse and develop solutions to real world problems in the broad areas of Mechanical Engineering using basic principles of math, sciences, numerical tools and experimental approaches.
2. Apply relevant analysis and experimental techniques by relating to the design and development lifecycle of providing innovative products and solutions.
3. Ability to analyze the complexity and aesthetics of interdisciplinary problems and contribute as an effective member of an interdisciplinary team.

IV. Curriculum

The four-year curriculum consists of courses wort a total of **174 credits**, with the courses categorized broadly as Mathematics and Sciences, Basic Engineering including Computer science, Core Mechanical Engineering and stream, Open electives, Humanities and management and Projects. Apart from these, French language is offered as an option for rest of the years.

Proposed Course Curriculum Outline – Semester Wise.

Semester I					
S. No.	**Course Name**	**Lecture**	**Tutorial**	**Practical**	**Credits**
1	Mathematics I (Calculus and ODEs)	4	1	0	5
2	Chemistry I	2	1	0	3
3	Introduction to Electrical and Electronics Engineering	2	1	2	4
4	Engineering Drawing	0	0	3	1.5
5	Mechanics	2	1	0	3
6	Earth and Environmental Sciences	2	0	0	2
7	Intro. to Entrepreneurship	0	0	3	1
8	Media Project	0	0	3	1.5
9	English	3	0	0	3
10	French I	0	2	0	0.5
Total credits					**24.5**
Semester II					
S. No.	**Course Name**	**Lecture**	**Tutorial**	**Practical**	**Credits**
1	Mathematics II (Linear algebra& Complex Analysis)	3	1	0	4
2	Physics I	2	1	2	4
3	Chemistry II	2	0	2	3
4	Introduction to computer sciences	2	1	2	4
5	Workshop Practice	0	0	2	1
6	Thermodynamics	2	1	0	3
7	Computer Aided Engineering Drawing	1	0	3	2.5
8	Entrepreneurship practice	0	0	2	1
9	Professional Ethics	0	1	0	1
10	French II	0	2	0	0.5
Total credits					**24**
Semester III					
S. No.	**Course Name**	**Lecture**	**Tutorial**	**Practical**	**Credits**
1	Mathematics III (Probability & Statistics)	3	1	0	4
2	Physics II	3	1	2	5
3	Introduction to Material sciences	2	0	2	3
4	Data Structures	2	2	2	5
5	Thermal Engineering	3	1	0	4
6	Mathematics IV (PDEs, Calculus of variations)	2	0	0	1
7	Lean Start-up	0	0	3	1
8	Principles of Economics (fractal)	3	0	0	1.5
9	French III	0	2	0	0.5
Total credits					**25**

Semester IV

S. No.	Course Name	Lecture	Tutorial	Practical	Credits
1	Numerical Methods	3	0	2	4
2	Fluid Mechanics	3	1	0	4
3	Solid Mechanics	2	1	0	3
4	Theory of Mechanisms (K&D)	4	0	0	4
5	Manufacturing Engineering	4	0	0	4
6	Financial Accounting	3	0	0	1.5
7	Design Thinking	1	0	2	2
8	French IV	0	2	0	0.5
Total credits					**23**

Semester V

S. No.	Course Name	Lecture	Tutorial	Practical	Credits
1	Fluid and solid Mechanics Lab	0	0	2	1
2	Measurement and Instrumentation	2	0	2	3
3	Heat and Mass transfer	3	1	0	4
4	Design of Machine Elements	3	1	0	4
5	Metrology and Computer integrated manufacturing	2	0	2	3
6	Stream course I	3	0	0	3
	Introduction to Robotics	3	0	0	3
7	HSS/Management Elective I	2	0	0	2
8	French V (Optional)	0	2	0	0
Total credits					**23**

Semester VI

S. No.	Course Name	Lecture	Tutorial	Practical	Credits
1	Machine learning	3	1	0	4
2	Introduction to Vibrations	3	0	0	3
3	Heat transfer, Energy systems, Vibrations Lab	0	0	3	1.5
4	Stream Course II	3	0	0	3
5	Open Elective I	3	0	0	3
6	HSS and Management Elective II	2	0	0	2
7	Systems Engineering Project	0	1	4	3
8	Professional development & employment skills	2	0	0	2
9	French VI (Optional)	0	2	0	0
Total credits					**21.5**

Semester VII

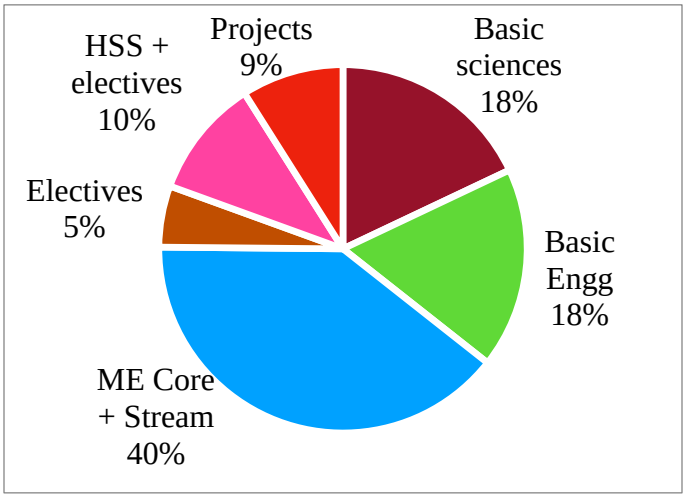
S. No.	Course Name	Lecture	Tutorial	Practical	Credits
1	Industrial Engineering and Operations Research	3	1	0	4
2	Control Theory	3	0	0	3
3	Stream Course III	3	0	0	3
4	Open Elective III	3	0	0	3
5	HSS and Management Elective III	2	0	0	2
6	Final Year Project I	0	1	4	3
7	French VII (Optional)	0	2	0	0
Total credits					**18**

Semester VIII

S. No.	Course Name	Lecture	Tutorial	Practical	Credits
1	Stream Course IV	3	0	0	3
2	Open Elective III	3	0	0	3
3	Final Year Project II	0	5	8	9
4	French VIII (Optional)	0	2	0	0
Total credits					**15**

The distribution of credits into the broad categories mentioned earlier is given below. The curriculum is designed for a balanced distribution of credits between basic sciences and engineering and the core program in mechanical engineering.

S.No.	Category	Credits
1	Basic Sciences	30
2	Basic Engineering	29.5
3	ME Core + Stream	66
4	Electives	9
5	HSS + electives	22.5
6	Projects	15



Streams of specialization

Mechanics and Materials

This specialization stream focusses on equipping students with the ability to describe and model processes, materials and mechanisms, applied to engineering design. The courses offered as part of this specialization stream are

a. Multiphysics
b. Finite element methods
c. Engineering materials
d. Intermediate Dynamics

Energy Systems

Energy is a globally significant challenge which would be relevant, perhaps, for decades into the future. This stream focusses covering the fundamental aspects of energy generation, conversion and energy systems with applications to combustion engines, turbines, alternative sources such as nuclear, wind and solar power and the economics of energy. The courses offered in this stream are

a. IC Engines and Gas Turbines
b. Computational Fluid Dynamics
c. Turbomachinery
d. Alternative Energy Sources

Automotive and Aerospace

This stream provides introduction to the systems relevant to transportation and mobility domains. This stream addresses technology relevant to industry demand in the future, such as electric vehicles. Further, courses such as rocket propulsion systems are addressed, which find relevance in the Indian context.

a. Electric vehicles
b. Vehicle Dynamics
c. Aerodynamics and Flight mechanics
d. Rocket propulsion

Mechatronics

This stream provides the necessary interdisciplinary background of electrical and electronics engineering applicable to designing, building and automating electro-mechanical systems.

a. Digital Signal and systems
b. Introduction to Mechatronics
c. **Actuators and sensors (??)**
d. Industry 4.0