School of Engineering

MIT-ADT UNIVERSITY
PUNE, INDIA
A Leap Towards World Class Education

Programme Curriculum

# BACHELOR OF TECHNOLOGY

PATTERN 2021

## Aerospace Engineering

## Faculty of Engineering

MIT-ADT UNIVERSITY
PUNE, INDIA
A Leap Towards World Class Education

# SCHOOL OF ENGINEERING, PUNE

## STRUCTURE & SYLLABUS

**FOR**

## Bachelor of Technology

# Aerospace Engineering

**UNDER FACULTY OF ENGINEERING**

**4 Year Undergraduate Programme Sanctioned by AC & BoS**

**(Pattern 2021 w.e.f. 2021-2022)**

**(160 Credits)**

## Department of Aerospace Engineering

# MIT- Art Design & Technology University

# MIT School of Engineering

# Department of Aerospace Engineering

## VISION

To be a premier center of excellence in Aerospace Engineering education that generates professionals for successful careers at national and international levels in the aerospace industry and research organizations.

## MISSION

To create dynamic Aerospace Engineering professionals to meet global technological challenges through research and innovation for the benefit of society.

## Program Educational Objectives (PEO'S) - Aerospace Engineering:

A graduate of MIT ADT University in Aerospace Engineering discipline should have a successful career in Aerospace Engineering or a related field, and within three to five years should attain the following:

**PEO –I: Preparation & Learning Environment**

To prepare and provide students with an academic environment for students to excel in postgraduate programs or to succeed in industry / technical profession and the life-long learning needed for a successful professional career in Aerospace Engineering and related fields.

**PEO –II: Core Competence**

To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.

**PEO –III: Breadth**

To train students with good scientific and engineering breadth so as to comprehend, analyze, design, and create novel products and solutions for real- life problems.

**PEO –IV: Professionalism**

To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context.

## Graduate Attributes (GA)

1. Engineering Knowledge
2. Problem Analysis
3. Design / Development of Solutions
4. Conduct Investigation of Complex Problems
5. Modern Tool Usage
6. The Engineer and Society
7. Environment and Sustainability
8. Ethics
9. Individual and Team Work
10. Communication
11. Project Management and Finance
12. Life – Long Learning

# Program Outcomes (PO)

## Engineering Graduate Will be able to:

1. PO1 - **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. PO2 - **Problem Analysis:** Identity, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. PO3 - **Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4. PO4 - **Conduct Investigations of Complex Problems**: 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.
5. PO5 - **Modern Tool Usage:** 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.
6. PO6 - **The Engineer and Society:** 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.
7. PO7 - **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. PO8 - **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. PO9 - **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. PO10 - **Communication:** 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.
11. PO11 - **Project Management and Finance:** 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.
12. PO12 - **Life-Long Learning:** 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 Outcomes (PSO's) - B. Tech Aerospace Engineering**

The programme is expected to deliver at the time of graduation,

1. PSO1: Ability to identify, formulate and solve engineering problems with the potential to design aerospace systems, components, or processes, to meet desired needs within socio- economic and ethical values.

2. PSO2: Ability to use the techniques, skills, and modern engineering tools necessary for aerospace engineering practices.

# Course Structure for B. Tech. Aerospace Engineering
## First Year B. Tech (2021 Batch)
## Semester I

| Sr. No. | Course Code | Course Name | L | T | P | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| 1 | 21BTAS101 | Linear Algebra and Calculus | 3 | 1 | 0 | 4 | 100 |
| 2 | 21BTAS102 | Applied Sciences | 4 | 0 | 2 | 5 | 150 |
| 3 | 21BTCS103 | Programming for Problem Solving | 2 | 0 | 4 | 4 | 150 |
| 4 | 21BTAE107 | Thermodynamics | 2 | 0 | 0 | 2 | 50 |
| 5 | 21BTAS104 | English Communication for Engineers | 2 | 0 | 2 | 3 | 100 |
| 6 | 21BTAE151 | Workshop Practice | 0 | 0 | 4 | Audit | - |
| 7 | 21BTME105 | Design Thinking Part I | 2 | 0 | 2 | 3 | 100 |
| 8 | 21SHD001 | SHD (Health Practice 1) | 0 | 0 | 2 | 1 | - |
| | | **Total** | **15** | **1** | **16** | **22** | **650** |

## Semester II

| Sr. No. | Course Code | Subject (Semester II) | L | T | P | Credits | Total Marks |
|---|---|---|---|---|---|---|---|
| 1 | 21BTAS201 | Ordinary Differential Equations and Advanced Calculus | 3 | 1 | 0 | 4 | 100 |
| 2 | 21BTEC202 | Basics of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | 150 |
| 3 | 21BTME203 | Engineering Graphics | 1 | 0 | 4 | 3 | 100 |
| 4 | 21BTAE202 | Engineering Mechanics | 3 | 0 | 0 | 0 | 100 |
| 5 | 21BTCS204 | Object Oriented Programming | 2 | 0 | 2 | 3 | 100 |
| 6 | 21BTAE251 | Material Engineering and Aerospace Materials | 2 | 0 | 0 | Audit | - |
| 7 | 21BTME205 | Design Thinking Part II | 0 | 0 | 2 | 1 | 50 |
| 8 | 21BTAE211 | Engineering Mechanics Laboratory | 0 | 0 | 2 | 1 | 50 |
| 9 | 21SHD002 | SHD (English Communication) | 1 | 0 | 2 | 2 | - |
| 10 | 21SHD003 | SHD (Health Practice 2) | 0 | 0 | 2 | 1 | - |
| | | **Total** | **15** | **1** | **16** | **22** | **650** |

## Semester III

| Course Code | Course Name | Hours/week | | | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total |
| 21BTAE301 | Machines and Mechanisms | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE302 | Introduction to Aerospace Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE303 | Fluid Mechanics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAS304 | Linear Differential Equations and Complex Variables | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE305 | Strength of Materials | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 21BTAE311 | Fluid Mechanics Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE312 | Machines & Mechanisms Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE313 | CADD Laboratory | 1 | 0 | 4 | 3 | 40 | 60 | 100 |
| **Total** | | **16** | **1** | **10** | **22** | **320** | **480** | **800** |

## Semester IV

| Course Code | Course Name | Hours/week | | | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total |
| 21BTAE401 | Numerical Methods | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 21BTAE402 | Heat Transfer | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE403 | Manufacturing Technology | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 21BTAE404 | Aerodynamics | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE405 | Electronics and Instrumentation | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE411 | Thermal Engineering Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE412 | Aerodynamics Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE413 | Electronics & Instrumentation Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| **Total** | | **17** | **0** | **10** | **22** | **320** | **480** | **800** |

## SEMESTER-V

| Course Code | Course Name | Hours/week | | | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total |
| 21BTAE501 | Aircraft Flight Mechanics | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 21BTAE502 | Aircraft Structures-I | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE503 | Propulsion-II | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE504 | Gas Dynamics | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE505 | Control Theory | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE511 | Aircraft Structures Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE512 | Propulsion- II Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE513 | Control Theory Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| **Total** | | **19** | **0** | **8** | **23** | **320** | **480** | **800** |

## Semester VI

| Course Code | Course Name | Hours/week | | | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total |
| 21BTAE601 | Aircraft Structures -II | 4 | 0 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE602 | Avionics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE603 | Computational Fluid Dynamics | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE604 | Rocket Propulsion | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE605 | Economics and Management for Engineers | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE606 | Introduction to Unmanned Air Vehicles | 1 | 0 | 2 | 2 | 100 | ---- | 100 |
| 21BTAE611 | Avionics Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE612 | Computational Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE620 | Mini Project | 0 | 0 | 4 | 2 | 100 | -- | 100 |
| **Total** | | **17** | **1** | **10** | **23** | **480** | **420** | **900** |

## SEMESTER-VII

| Course Code | Course Name | Hours/week | | | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total |
| 21BTAE701 | Space Flight Mechanics | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 21BTAE702 | Vibrations and Aero-elasticity | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE703 | Aircraft Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE___ | Elective-I | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE___ | Elective-II | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE711 | Aircraft Design Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE712 | Vibrations & Aero-elasticity Laboratory | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 21BTAE720 | Project Phase-I | 0 | 0 | 6 | 3 | 100 | -- | 100 |
| 21BTAE720 | Scientific Communication and Writing Skills | 2 | 0 | 0 | 0 (Audit) | --- | ----- | ---- |
| **Total** | | **15** | **1** | **12** | **21** | **380** | **420** | **800** |

## SEMESTER-VIII

| Course Code | Course Name | Hours/week | | | | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total |
| 21BTAE___ | Elective-III (Online Course) | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 21BTAE851 | Environmental Studies | 2 | 0 | 0 | 0 (Audit) | ---- | ---- | ----- |
| 21BTAE821 | Project Phase-II | 0 | 0 | 24 | 12 | 100 | 200 | 300 |
| **Total** | | **3** | **0** | **24** | **15** | **140** | **260** | **400** |

## Electives

| Elective | Course Name | |
|---|---|---|
| Elective-I | 21BTAE731 | Finite Element Analysis |
| | 21BTAE732 | Experimental Aerodynamics |
| | 21BTAE733 | Optimization |
| | 21BTAE734 | Operations Research |
| | 21BTAE735 | Fundamentals of Combustion |
| | 21BTAE736 | Total Quality Management |
| Elective-II | 21BTAE737 | Lighter than Air Systems |
| | 21BTAE738 | Introduction to Composite Materials & Structures |
| | 21BTAE739 | Supply Chain Management |
| | 21BTAE740 | Machine Learning |
| | 21BTAE741 | Aircraft Maintenance and Repair |
| | 21BTAE742 | Reliability Engineering |
| Elective-III | 21BTAE831 | Advanced Manufacturing Processes |
| | 21BTAE832 | Aircraft Systems |
| | 21BTAE833 | Spacecraft Dynamics and Control |
| | 21BTAE834 | Aircraft Control |