National Institute of Technology Meghalaya
An Institute of National Importance

CURRICULUM

Program	**Minor Degree in Aerospace Engineering**	Year of Regulation	**2026**
Department	**Mechanical Engineering**	Semester	**V**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
ME 363	**Aerospace Structures, Materials, and Manufacturing**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives

- To provide fundamental knowledge of aerospace structural systems, aerospace materials, and lightweight design principles used in aircraft and spacecraft applications.
- To develop understanding of structural mechanics, composite technologies, manufacturing processes, and joining techniques employed in modern aerospace industries.
- To familiarize students with advanced aerospace production technologies, structural integrity assessment, non-destructive testing, and high-temperature aerospace systems for safe and efficient engineering applications.

Course Outcomes

ME363.1	Explain the structural configuration, functional requirements, and design considerations of modern aerospace vehicles and systems.
ME363.2	Select suitable aerospace materials based on mechanical, thermal, and environmental performance requirements for aircraft and spacecraft applications.
ME363.3	Analyze the behavior of aerospace structural components under static, dynamic, thermal, and fatigue loading conditions.
ME363.4	Evaluate composite materials and lightweight structural concepts used in advanced aerospace engineering applications.
ME363.5	Apply conventional and advanced aerospace manufacturing, joining, inspection, and quality assurance techniques in aerospace production environments.
ME363.6	Assess structural integrity, failure mechanisms, and emerging digital manufacturing technologies for reliable and sustainable aerospace systems.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	ME363.1	3	2	1	–	–	–	–	–	–	1	–	1		
2	ME363.2	3	2	2	1	1	–	1	–	–	–	–	1		
3	ME363.3	3	3	2	2	1	–	–	–	–	–	–	1		
4	ME363.4	2	3	3	2	1	–	1	–	–	–	–	1		
5	ME363.5	2	2	3	2	3	–	1	–	1	1	2	1		
6	ME363.6	3	3	2	2	2	1	1	–	–	–	–	2		

SYLLABUS

No.	Content	Hours	COs
I	**Fundamentals of Aerospace Structures:** Structural configuration of aerospace vehicles, fuselage, wings, empennage, landing gear, and control surfaces. Load paths, aerodynamic loading, structural efficiency, weight minimization, and safety considerations in aerospace design. Overview of modern aerospace platforms including UAVs/MAVs, launch vehicles, and satellites.	4	ME363.1
II	**Aerospace Materials and Applications:** Selection and properties of aerospace materials including aluminum alloys, titanium alloys, magnesium alloys, stainless steels, and nickel-based superalloys. Composite materials, ceramic matrix composites, smart materials, and thermal protection materials. Material behavior under fatigue, creep, corrosion, and high-temperature environments.	4	ME363.1
III	**Mechanics of Aerospace Structures:** Stress-strain behavior, bending, torsion, shear flow, buckling, vibration, and stability of thin-walled aerospace structures. Structural analysis of wings, fuselage sections, stiffened panels, and pressure vessels. Concepts of fail-safe design, damage tolerance, and structural redundancy in aerospace systems.	5	ME363.3
IV	**Composite Structures and Lightweight Design:** Fundamentals of composite materials, lamina and laminate behavior, fiber orientation, anisotropic properties, and failure mechanisms. Design of lightweight aerospace structures using composites - aircraft wings, propeller, fan, compressor, and turbine blades, UAV/MAV frames, rocket casings, and satellite panels.	5	ME363.4
V	**Aerospace Manufacturing Processes:** Precision machining, CNC machining, sheet metal forming, superplastic forming, diffusion bonding, welding, brazing, riveting, and adhesive bonding. Metallic and Nonmetallic Material Processing. Aerospace process planning, dimensional accuracy, tolerance control, and production quality requirements. Manufacturing case studies of aircraft, spacecraft, launch vehicles and missiles.	7	ME363.5
VI	**Additive Manufacturing and Digital Aerospace Production:** Additive manufacturing technologies including FDM, SLM, EBM, and directed energy deposition. CAD/CAM integration, digital twins, simulation-driven manufacturing, automated inspection, and smart aerospace factories.	5	ME363.6
VII	**Joining, Inspection, and Quality Assurance:** Riveted, bolted, bonded, and hybrid joining techniques used in aerospace assembly. Structural integrity of joints, vibration resistance, and leak-proof assembly systems. Non-destructive testing methods including ultrasonic testing, radiography, eddy current testing, and thermography. Aerospace quality standards and certification practices.	6	ME363.5
VIII	**Structural Integrity and High-Temperature Aerospace Systems:** Fatigue-fracture mechanics, crack propagation, creep, corrosion fatigue, and life prediction methods. Structural health monitoring and reliability assessment. Thermal stresses, thermal barrier coatings, ablative materials, and high-temperature structures used in hypersonic vehicles, rocket nozzles, and re-entry systems.	6	ME363.6
	Total Hours	**42**	

Essential Readings

1. Megson, T. H. G. (2012). Aircraft Structures for Engineering Students. Elsevier.
2. Peery, D. J. (2011). Aircraft Structures. Courier Corporation.
3. Titterton, G. F. (1951). Aircraft Materials and Processes. Himalayan Books.
4. Buhl, H. (Ed.). (2012). Advanced Aerospace Materials. Springer.

Supplementary Readings

1. Bruhn, E. F. (1973). Analysis and Design of Flight Vehicle Structures. Tri-state Offset Co.
2. Niu, M. C. Y. (2011). Airframe Stress Analysis and Sizing. Hong Kong Conmilit Press Ltd.
3. Gupta, B. (2009). Aerospace Material. S Chand & Co.
4. Prasad, N. E., & Wanhill, R. J. H. (Eds.). (2017). Aerospace Materials and Material Technologies. Springer.