

Dr.AMBEDKAR INSTITUTE OF TECHNOLOGY, BENGALURU-56
School of Core Engineering & Technology
Aeronautical Engineering Programme

Scheme and Syllabus

OBE – CBCS

2025 Batch (2025 Scheme)

AY 2026-27

3rd and 4th Semesters



Dr. Ambedkar Institute of Technology, Bengaluru-560056 B.E. PROGRAMME: <u>AERONAUTICAL ENGINEERING</u> Scheme of Teaching and Examination effective from the Academic Year 2026 – 27 Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)																
III SEMESTER																
Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)		Teaching & Learning Scheme				Examination				Credits		
						CI		LI	TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks	
						L	T	P	SL							
1	ASC	1BSCET301	Probability and Statistics	TD /PSB: Mathematics / CS Allied		42	28	0	50	120	3	50	50	100	4	
2	PCC	1BSCET302	Mechanics of Materials	AE		42	28	0	50	120	3	50	50	100	4	
3	PCCL	1BAEL303	Computer Aided Aircraft Drawing	AE		0	0	28	02	30	2	50	50	100	1	
4	IPCC	1BAEU304	Fluid Mechanics	AE		42	0	28	50	120	3	50	50	100	4	
5	PCC	1BAET305	Elements of Aeronautics	AE		42	0	0	48	90	3	50	50	100	3	
6	PCC	1BAET306	Aircraft Materials and Manufacturing Process	AE		42	0	0	48	90	3	50	50	100	3	
7	AEC	1BAEL307A	Basics of MATLAB	AE		0	0	28	02	30	2	50	50	100	1	
8	SDC	1BPRJ308	Community Project (Project - Based Learning) / Societal Project	AE		0	0	0	30	30	2	50	50	100	1	
9	MC	1BCDN309	Placement	Placement Cell		2	0	0	0	--	--	50	--	50	PP/NP	
10	NCMC	1BNSN310	National Service Scheme (NSS)	Campus	NSS coordinator		0	0	0	28	28	--	100	---	100	PP
		Physical Education Director														
		Yoga Teacher														
		Music Teacher														
Total										658		550	400	950	21	
11	NCMC	1BMATDIP31	Mathematics course for Lateral Entry Students	TD -Maths Dept.		14	0	0	14	28	3	100	---	100	PP	
Total										686		650	400	1050	21	

TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning

Ability Enhancement Course (Laboratory) 1BAEL307x			
1BAEL307A	Basics of MATLAB		
** The course 1BXXL307 – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the course 1BXXL307 – Ability Enhancement Course Laboratory shall be offered as multiple elective options under the course codes 1BXXL307x (where $x = A, B, C, D$). Note to Chairpersons: If only one course is selected, the title of the course may please be entered at serial number 7 of the Scheme of Teaching and Examinations and the above table along with this row shall be deleted. In case, multiple courses are selected the above table shall be filled with the course titles and this row shall be deleted.			

Dr. Ambedkar Institute of Technology, Bengaluru-560056
B.E. PROGRAMME: AERONAUTICAL ENGINEERING
Scheme of Teaching and Examination effective from the Academic Year 2026 – 27
Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)

IV SEMESTER

Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)		Teaching & Learning Scheme					Examination				Credits
						CI		LI	# TW & SL	TH/S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P							
1	PCC	1BAET401	Aerothermodynamics	AE		42	28	0	50	120	3	50	50	100	4
2	IPCC	1BAEU402	Aircraft Propulsion	AE		42	0	28	50	120	3	50	50	100	4
3	PCC	1BAET403	Aerodynamics	AE		42	28	0	50	120	3	50	50	100	4
4	PCC	1BAET404	Aircraft Structures	AE		42	28	0	50	120	3	50	50	100	4
5	PCCL	1BAEL405	Aircraft Structures Laboratory	AE		0	0	28	02	30	2	50	50	100	1
6	AEC	1BAEL406A	Additive Manufacturing Technology Laboratory	AE		0	0	28	02	30	2	50	50	100	1
7	BSC	1BBIT407	Biology For Aeronautical Engineers	AE		28	0	0	32	60	3	50	50	100	2
8	SDC	1BEP408	Environmental Science Project	AE		0	0	0	30	30	3	50	50	100	1
9	MC	1BCDN409	Placement	Placement Cell		2	0	0	0	--	--	50	--	50	PP/NP
10	NCMC	1BNSN410	National Service Scheme (NSS)	Campus	NSS coordinator	0	0	0	28	28	--	100	---	100	PP
		1BPEN410	Physical Education (PE) (Sports and Athletics)		Physical Education Director										
		1BYON410	Yoga		Yoga Teacher										
		1BMUN410	Music		Music Teacher										
Total										658		550	400	950	21
11	NCMC	1BMATDIP411	Mathematics course for Lateral Entry Students	TD -Maths Dept/ VTU Online (COE).		14	0	0	14	28	--	100	--	100	PP
Total										686		650	400	1050	21

Ability Enhancement Course (Laboratory) 1BAEL406x	
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1BAEL406A	Additive Manufacturing Technology Laboratory		
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TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning, ** The course 1BAEL406x – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the Ability Enhancement Course Laboratory course can be offered with multiple elective options under the course codes 1BAEL406x (where $x = A, B, C, D$).

Dr. Ambedkar Institute of Technology, Bengaluru-560056
B.E. PROGRAMME: AERONAUTICAL ENGINEERING
Scheme of Teaching and Examination effective from the Academic Year 2026 – 27
Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)

V SEMESTER														
Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching & Learning Scheme					Examination				Credits
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P							
1	HSMC	1BAET501	Aviation Management	AE	42	0	0	48	90	3	50	50	100	3
2	IPCC	1BAEU502	Flight Mechanics	AE	42	0	28	50	120	3	50	50	100	4
3	PCC	1BAET503	Finite Element Method	AE	42	0	0	48	90	3	50	50	100	3
4	PCC	1BAET504	Introduction to Avionics	AE	42	0	0	48	90	3	50	50	100	3
5	PEC	1BAET505x	Professional Elective Course-I	AE	42	0	0	48	90	3	50	50	100	3
6	BSC	1BRM506	Research Methodology and IPR	AE	28	0	0	32	60	02	50	50	100	2
7	PCCL	1BAEL507	Aerodynamics Lab	AE	0	0	28	02	30	02	50	50	100	1
8	SDC	1BAE508	Hackathon-Based Project	CIE: By Departments SEE: Evaluation by industry experts	0	0	0	60	60	--	50	50	100	2
	Total								630		400	400	800	21
# TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning														
	Professional Elective Course-I													
	1BAET505A	Aircraft Maintenance, Repair and Overhaul			1BAET505C		Introduction to Space Mechanics							
	1BAET505B	Heat and Mass Transfer			1BAET505D		Turbo Machines							

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B.E. PROGRAMME: AERONAUTICAL ENGINEERING
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VI SEMESTER														
Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching & Learning Scheme					Examination				Credits
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	1BAET601	Computational Fluid Dynamics	AE	42	0	28	50	120	3	50	50	100	4
2	PCC	1BAET602	Theory of Vibration	AE	42	0	0	48	90	3	50	50	100	3
3	PCC	1BAET603	Flight Vehicle Design	AE	42	0	0	48	90	3	50	50	100	3
4	PCC	1BAET604	Aircraft Systems & Instrumentation	AE	42	0	0	48	90	3	50	50	100	3
5	PEC	1BAET605x	Professional Elective Courses-II	AE	42	0	0	48	90	3	50	50	100	3
6	PCCL	1BAEL606	Aircraft Systems & Instrumentation Laboratory	AE	0	0	28	2	30	2	50	50	100	1
7	AEC	1BAEL607	UAV Lab/FEA Lab	AE	0	0	28	2	30	2	50	50	100	1
8	SDC	1BAEP608	Capstone Project - Phase I	AE	0	0	0	90	90	3	100	--	100	3
9	NCMC	1BAE 609	Universal Human Value	TD/PSB- AE/AE	1	0	0	27	28	--	100	---	100	PP
	Total								630		550	350	900	21
# TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning														

Professional Elective Course-II				
1BAET605A	Smart Materials	1BAET605C	Aero Elasticity	
1BAET605B	Helicopter Dynamics	1BAET605D	Gas Turbine Technology	

Dr. Ambedkar Institute of Technology, Bengaluru-560056
B.E. PROGRAMME: AERONAUTICAL ENGINEERING
Scheme of Teaching and Examination effective from the Academic Year 2026 – 27
Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)

VII SEMESTER (Swappable VII and VIII SEMESTER) (SCHEME-A)														
Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits	
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks		Total Marks
1	IPCC	1BAEU701	Flight Testing	AE	42	0	28	50	120	3	50	50	100	4
2	PEC	1BAET702x	Professional Elective Course-III	AE	42	0	0	48	90	3	50	50	100	3
3	PEC	1BAET703x	Professional Elective Course -IV	AE	42	0	0	48	90	3	50	50	100	3
4	OEC	1BAET704x	Open Elective Course-I	AE	42	0	0	48	90	3	50	50	100	3
5	SDC	1BAEP705	Capstone Project - Phase-II	AE	0	0	0	210	210	3	100	100	200	7
6	NCMC	1BIKS706	Indian Knowledge System	TD/PSB- AE/AE	1	0	0	27	28	---	100	--	100	PP
	Total								628	15	400	300	700	20
# TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning														
	Professional Elective Course-III													
1BAET702A	Control Engineering				1BAET702C	Airworthiness								
1BAET702B	Aircraft Structural Health Monitoring				1BAET702D	Counter Drone Technology								
	Professional Elective Course-IV													
1BAET703A	Rapid Prototyping				1BAET703C	Flight Control system								
1BAET703B	AI for Aerospace Applications				1BAET703D	Wind Tunnel Techniques								
	Open Elective Course-I													
1BAET704A	Introduction to Drone Technology													
1BAET704B	Aircraft Interior Design													

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B.E. PROGRAMME: AERONAUTICAL ENGINEERING
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VIII SEMESTER (Swappable VII and VIII SEMESTER) (SCHEME-A)

Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours / Week					Examination				
					CI		LI	# TW & SL	# TH/S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P							
1	PEC	1BAET801x	Professional Elective-V (NPTEL/VTU Online Course)	Online Evaluation					90	3	50	50	100	3
2	OEC	1BAET802x	Open Elective-II (NPTEL/VTU Online Course)	Online Evaluation					90	3	50	50	100	3
3	SDC	1BAEI803x	Internship (15 weeks or 90 working days)	--	--	--	--	--	360	3	100	100	200	09
Total									540	9	200	200	400	15

	Professional Elective Course (Online courses)-V
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1BAET801A	NPTEL/VTU Online Course	1BAET801C		NPTEL/VTU Online Course
1BAET801B	NPTEL/VTU Online Course	1BAET801D		NPTEL/VTU Online Course
	Open Elective Courses -II (Online Courses)			
1BAE802A	NPTEL/VTU Online Course	1BAE802C		NPTEL/VTU Online Course
1BAE802B	NPTEL/VTU Online Course	1BAE802D		Foreign Language / SWAYAM/online VTU) (NPTEL

TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning

	Types of Internships (Course Code: 1BAE803x)
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Students shall undertake one of the following internship types during the eighth semester, as per academic guidelines:

1. **1BAE803A – Industry Internship:** Shall involve practical exposure and training within an industrial or corporate setting.
2. **1BAE803B – Research Internship:** Shall focus on academic or applied research under the guidance of faculty or research institutions.
3. **1BAE803C – Post-Placement Internship:** Shall be undertaken by students who have secured placement, aligning with their future employment domain.
4. **1BAE803D – Societal Internship:** Shall engage students in community-based or social impact projects with NGOs, government bodies, or civic organizations.
5. **1BAE803E – Online Internship:** Shall be conducted through recognized digital platforms offering structured internship modules.
6. **1BAE803F – Skill Enhancement Internship:** Shall be opted by students unable to secure internships, offering credit equivalence through curated online courses available at [http:// www.online.vtu.ac.in](http://www.online.vtu.ac.in)

	To ensure uniformity, quality, and transparency in the internship process, VTU has launched a centralized web portal that serves as a single platform for all internship opportunities. Reputed industries, Centres of Excellence, Research Laboratories, and other recognized bodies will be registered on this portal. Students must choose internships exclusively through this portal. No other mode of internship selection will be permitted
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VII and VIII semesters for the candidates who opt for a two-semester internship along with Capstone Project (Scheme B)														
Sl.No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching & Learning Scheme				#- TH/S	Examination				Credits
					CI		LI	# TW & SL		Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P							
1	IPCC	1BAET701	To be completed in the Summer Semester after 6th semester							3	50	50	100	4
2	PEC	1BAET702x	Professional Elective Course-III (NPTEL/VTU Online Course)	Online Evaluation						--	50	50	100	3
3	PEC	1BAET703x	Professional Elective Course-IV (NPTEL/VTU Online Course)	Online Evaluation						--	50	50	100	3
4	OEC	1BAET704x	Open Elective Course (NPTEL/VTU Online course)-I	Online Evaluation						---	50	50	100	3
5	SDC	1BAEP705	Capstone Project - Phase-II***	AE						3	100	100	200	7
6	NCMC	1BIKS706	Indian Knowledge System	TD/PSB-AE/AE	1	0	0	27	28	--	100	--	100	PP
	Total								28	6	400	300	700	20
1	PEC	1BAET801x	Professional Elective-V (NPTEL/VTU Online Course)	Online Evaluation						---	50	50	100	3
2	OEC	1BAET802x	Open Elective-II (NPTEL/VTU Online Course)	Online Evaluation						---	50	50	100	3
3	SDC	1BAEI803x	Internship (Two- semester internship for a minimum (Period of 180 working days or -30 weeks)	AE						3	50	50	100	09
	Total									3	150	150	300	15
# TH/S- Total Hours per Semester, TW & SL- Term Work & Self Learning														
	7 th semester and 8 th semester Credits Total													38

	NPTEL/VTU Online Professional Elective Course - III			
1BAE703A	NPTEL/VTU Online Courses	1BAE703C		NPTEL/VTU Online Courses
1BAE703B	NPTEL/VTU Online Courses	1BAE704D		NPTEL/VTU Online Courses

	NPTEL/VTU Online Open Elective Courses - I			
1BAE704A	NPTEL/VTU Online Courses	1BAE704C		NPTEL/VTU Online Courses
1BAE704B	NPTEL/VTU Online Courses	1BAE704D		NPTEL/VTU Online Courses
	NPTEL/VTU Online Professional Elective Course (Online Courses)-IV			
1BAE801A	NPTEL/VTU Online Courses	1BAE801C		NPTEL/VTU Online Courses
1BAE801B	NPTEL/VTU Online Courses	1BAE801D		NPTEL/VTU Online Courses
	NPTEL/VTU Online Open Elective Courses (Online Courses)-III			
1BAE802A	NPTEL/VTU Online Courses	1BAE802C		NPTEL/VTU Online Courses
1BAE802B	NPTEL/VTU Online Courses	1BAE802D		Foreign Language (NPTEL/MOOC/online VTU)

Course Title	PROBABILITY AND STATISTICS						
Course Code	1BSCET301						
Course Category	ASC (Applied Science Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	03	02	0	4	5	42+28+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:

This course is proposed to impart to the students the skills to identify and solve problems in their field of study involving the application of numerical and probability distribution techniques.

SYLLABUS	No. of Hours	BTLs
UNIT 1	10	L1-L4
Statistical techniques: Curve fitting by method of least squares: $y = ax + b$, $y = ax^2 + bx + c$ and $y = ab^x$. Correlation–Karl Pearson’s coefficient of correlation, Regression analysis – lines of regression (without proof), angle between regression lines-problems.		
<u>SELF-STUDY COMPONENTS:</u> Rank correlation, Growth modeling.		
UNIT 2	10	L1-L4
Probability Distributions: Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation and variance. Binomial, Poisson, normal and exponential distributions-only problems		
<u>SELF-STUDY COMPONENTS:</u> Geometric and Gamma distributions, Application to transmission errors in noise media.		
UNIT 3	10	L1-L4
Joint Probability Distributions and Markov Chains: Introduction, Joint probability and Joint distribution of discrete random variables, Markov chains, Classification of Stochastic processes, Probability vector, Stochastic matrix, Regular stochastic matrix, Transition probabilities and Transition probability matrix.		
<u>SELF-STUDY COMPONENTS:</u> Joint probability and Joint distribution of continuous random variables.		
UNIT 4	10	L1-L4
Numerical Solutions of Partial Differential Equations: Solutions of Laplace equation-Gauss-Seidel method, one dimensional heat equation- Bendre-Schmidt method. Wave Equation-Finite difference method. Reynold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates. Numerical problems.		

SELF-STUDY COMPONENTS:

Solutions of Poisson equations, Finite element methods.

UNIT 5**10****L1-L4**

Calculus of variations: Variation of a function and a functional, Euler's equation-standard variational problems, Geodesics on a plane surface and hanging cable problems.

SELF-STUDY COMPONENTS:

Isoperimetric problems, Rayleigh Ritz method -problems.

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics. Khanna Publishers, New Delhi.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons.
3. Glyn James, Advanced modern Engineering Mathematics, Pearson Publications.
4. S.S. Sastry, Introductory methods of numerical analysis, PHI.
5. H.C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

- | | |
|---|--|
| 1 | B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Education.. |
| 2 | Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press |
| 3 | C. Ray Wylie, Louis C. Barrett, Advanced Engineering Mathematics, McGraw Hill Book Co., New York |
| 4 | H.K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publication |

e-LEARNING RESOURCES:

- | | |
|---|---|
| 1 | http://nptel.ac.in/courses.php?disciplineID=111 |
| 2 | http://www.class-central.com/subject/math(MOOCs) |
| 3 | VTU e-Shikshana Program |
| 4 | VTU EDUSAT Program |

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each.

The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

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Dr. Ambedkar Institute of Technology, Bengaluru - 560056

School of Core Engineering & Technology

Program: Aeronautical Engineering

Semester: III

Scheme: 2025

Academic Year: 2026-27

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1									
CO2									
CO3									
CO4									
CO5									

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1																	
CO2																	
CO3																	
CO4																	
CO5																	

Course Coordinators:

Dr. Divya Darshini S
Assistant Professor,
School of Basic Sciences and Humanities,
Dr. A.I.T

Dr. Latha D N
Assistant Professor,
School of Basic Sciences and Humanities,
Dr. A.I.T

Heads of Programme

Head of School

Dr. Shivaprassana G S,
Associate Professor,
School of Basic Sciences and Humanities,
Dr. A.I.T

Dr. Jambunath Baligar,
Professor,
School of Basic Sciences and Humanities,
Dr. A.I.T

Course Title		MECHANICS OF MATERIALS						
Course Code		1BSCET302						
Course Category		PCC (Professional Core Course)						
Teaching-Learning Scheme & Credit		L	T	P	S	Total	Total Hours	Credit
		3	1	0	3	3	42+28+0+50=120	4
CIE Marks: 50		SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	
Common Branches		CV/ME/AE/IM						
Course Learning Objectives:								
CLO1	Understand the concepts of stress, strain, elastic constants, and deformation behavior of engineering materials under different loading conditions.							
CLO2	Analyze biaxial stress systems and determine principal stresses and maximum shear stresses using analytical and graphical methods.							
CLO3	Evaluate shear force and bending moment distributions in beams subjected to various loading conditions.							
CLO4	Apply the theory of bending and shear stress distribution for the analysis and design of beam sections.							
CLO5	Analyze torsional behavior of shafts and stress distribution in thin and thick cylindrical pressure vessels used in engineering applications.							
SYLLABUS							No. of Hours	BTLs
UNIT 1							9	L1-L4
SIMPLE STRESS AND STRAIN: Definition & types of stresses and strains, Stress strain diagram for brittle and ductile materials - Poisson's ratio & volumetric strain – Elastic constants – relationship between elastic constants and Poisson's ratio – Generalized Hooke's law – Deformation of simple and compound bars, Thermal stresses, Principle of Superposition.								
SELF-STUDY COMPONENTS: Analysis of bars of varying cross-sections, Stresses in Composite Sections.								
UNIT 2							9	L1-L4
BI-AXIAL STRESS SYSTEM: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Stresses on an oblique section of a body subjected to a direct stress in one plane, Stresses on an oblique section of a body subjected to a direct stress in two mutually perpendicular directions – analytical & graphical method - Mohr's circle for plane stress.								
SELF-STUDY COMPONENTS: Stresses on an oblique section of a body subjected to a simple shear stress, direct stress in one plane and accompanied by a simple shear stress, direct stresses in mutually perpendicular directions and accompanied by a simple shear stress								

UNIT 3	8	L1-L4
BENDING MOMENT AND SHEAR FORCES IN BEAMS: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, couple and combination of these loads –Point of contraflexure.		
SELF-STUDY COMPONENTS: Load and Bending moment diagrams from shear force diagram, Beams subjected to inclined loads, SF and BM diagrams for inclined beams.		
UNIT 4	8	L1-L4
THEORY OF SIMPLE BENDING: Assumptions – Derivation of bending equation - Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T – Design of simple beam sections SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections - rectangular, circular, triangular, I, and T sections.		
SELF-STUDY COMPONENTS: Bending Stresses in Unsymmetrical sections, Distribution of shear stresses over miscellaneous section.		
UNIT 5	8	L1-L4
TORSION OF CIRCULAR SHAFTS: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts.		
THICK AND THIN CYLINDERS: Stresses in thin cylinders, Lamé's equation for thick cylinders subjected to internal and external pressures, Changes in dimensions of cylinder (diameter, length and volume), simple numericals.		
SELF-STUDY COMPONENTS: Torsion in shaft of varying cross sections, Composite shafts, Shaft couplings, Stresses in thin and thick cylindrical shells.		
THEORY OF COLUMNS – Long column and short column - Euler's formula – Rankine's formula.		

TEXT BOOKS:	
1	"Strength of Materials", S. Ramamrutham, Twentieth Edition, Dhanpat Rai & Sons.
2	"Strength of Materials", S.S. Rattan, Second Edition, Tata McGraw Hill Education India.
3	Strength of Materials 3Ed Part 2 Advanced Theory And Problems (Pb 2002), TIMOSHENKO S. 1 January 2002.
4	"Strength of Materials", R.K. Bansal, Ixmi Publications Pvt. Ltd., New Delhi, 2018.

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Understand the concepts of stress, strain, elastic constants, thermal stresses, and determine deformation in simple and composite members subjected to axial loading.
CO2	Analyze biaxial stress systems and determine principal stresses, principal planes, and maximum shear stresses using analytical methods and Mohr's circle.
CO3	Construct and interpret shear force and bending moment diagrams for beams subjected to different types of loads.
CO4	Determine bending and shear stresses in beam sections and design simple beam sections based on strength requirements.
CO5	Analyze torsional stresses in circular shafts and evaluate stresses and dimensional changes in thin and thick cylinders subjected to pressure loading.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1														
CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2						2	3		
CO2	3	3	3	3	2						2	3		
CO3	3	3	3	3	2						2	3		
CO4	3	3	3	3	2						2	3		
CO5	3	3	3	3	2						2	3		

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1										
CO/WK	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	3	2	2	1				1	
CO2	3	3	3	2	2				1	
CO3	3	3	3	3	2				1	
CO4	3	3	3	3	3	1	1		1	
CO5	3	3	3	3	3	2	1		2	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3					2		1						
CO2				2					3		2	1					
CO3				2					3		3	2	1				
CO4				2					3		3	3	2				
CO5				2					3		3	3	2				1

Dr. Ambedkar Institute of Technology, Bengaluru - 560056

School of Core Engineering & Technology

Program: Aeronautical Engineering

Semester: III

Scheme: 2025

Academic Year: 2026-27

Course Coordinators:

Prof. Rajesh Chandra C.,	Dr. C. R. Mahesha,	Prof. Purnima K. B.	Prof. Archana M.
Assistant Professor,	Assistant Professor,	Assistant Professor,	Assistant Professor,
Mechanical Engineering	Industrial Engineering & Management	Civil Engineering	Aeronautical Engineering

Heads of Program:

Dr. Sathish S.	Dr. Rajeshwari P.	Dr. Syed Abu Sayeed Mohammed	Dr. Kumara Thanaiah,
Professor,	Professor,	Associate Professor,	Assistant Professor,
Mechanical Engineering	Industrial Engineering & Management	Civil Engineering	Aeronautical Engineering

Head of School

Dr. S. Kavitha

Professor,

School of Core Engineering and Technology, Dr. A.I.T

Course Title	COMPUTER AIDED AIRCRAFT DRAWING					
Course Code	1BAEL303					
Course Category	PCCL					
Scheme and Credits	No. of Hours/Week					Credits
	L	T	P	S	TH/S	
	0	0	28	2	30	
Total no of contact hours	30 hours					
Exam Duration: 03 Hrs.	Max. Marks: CIE+SEE = 50+50=100					
Pre-requisites	Computer Aided Engineering drawing					

Course Learning Objectives:	
1	Understand and interpret drawings of machine and aircraft components.
2	Prepare assembly drawings either manually or by using standard packages.
3	Familiarize with standard components and their assembly of an aircraft.

Sl. No	Experiments
1	Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Seller's thread, American Standard thread.
2	Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.
3	Keys & Joints: Parallel key, Taper key, Feather key, Gibhead key and Woodruff key.
4	Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.
5	Couplings: Split Muff coupling, protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)
6	3D Geometric Modeling and Assembly of an Aircraft Propeller and Hub using SolidWorks/CATIA
7	3D Modeling and Assembly of an Aircraft Wing using SolidWorks/CATIA
8	3D Geometric Modeling and Assembly of an Aircraft Fuselage Structure using SolidWorks/CATIA
9	3D Modeling and Assembly of an Aircraft Landing Gear System using SolidWorks/CATIA
10	3D Modeling and Assembly of a Fixed-Wing UAV(Quadcopter frame) using SolidWorks/CATIA

Course Outcomes:	
After the completion of the course the student will be able to:	
1	Distinguish drawings of machine and aircraft components
2	Identify assembly drawings either manually or by using standard CAD packages.
3	Practice with standard components and their assembly of an aircraft

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	0	0	0	0	0	1	0	0	2	1	0
CO2	3	3	3	0	0	0	0	0	1	0	0	2	1	0
CO3	3	3	3	0	0	0	0	0	1	0	0	2	1	0

Course Coordinator

Mr. Balaraja N C

Assistant Professor

Aeronautical Engineering
Programme, DrAIT**Head of Programme**

Dr. Kumara Thanaiah

Associate Professor

Aeronautical Engineering
Programme, DrAIT**Head of School**

Dr.S Kavitha

Professor

School of Core Engineering &
Technology, DrAIT

Course Title	FLUID MECHANICS					
Course Code	1BAEU304					
Course Category	IPCC (Professional Core Course)					
Scheme and Credits	No. of Hours/Week					Credits
	L	T	P	S	TH/S	
	42	0	28	50	120	
Total no of contact hours	70 hours					
Exam Duration: 03 Hrs.	Max. Marks: CIE+SEE = 50+50=100					
Pre-requisites	Physics, Mathematics					

Course Learning Objectives:	
1	Explain various properties related to fluid mechanics.
2	Determine hydrostatic force and Centre of pressure on plane and curved surfaces, locate met Centre and Meta centric height of floating bodies.
3	Summarize different types of pressure measurement devices.
4	Apply laws of conservation of momentum, mass and energy to fluid flow systems and explain the measurement of fluid flow parameters.
5	Interpret compressibility of gases in terms of Mach number.

Syllabus	No. of hours	BTLs
Unit 1		
PROPERTIES OF FLUID: Introduction, classification of fluids, properties of fluids, viscosity, surface tension, capillarity, vapor pressure, cavitation phenomenon. Numerical problems. Fluid statics: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Numerical problems.	09L+06T+10S	L1-L4
<u>Self-Study Component:</u> Practical applications of fluid properties, apply fluid statics principles to engineering systems and Analyze pressure measurement systems.		
Unit 2		
SUBMERGED BODIES: Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid. Related numerical problems. BUOYANCY: Buoyancy, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of metacentric height experimentally and theoretically. Numerical problems.	08L+05+10S	L1-L4
<u>Self-Study Component:</u> Importance of hydrostatic pressure distribution on engineering structures, Analyse hydrostatic forces acting on Reservoir walls and Swimming pool walls and Applications of Buoyancy in Ocean Engineering.		

Unit 3		
FLUID KINEMATICS: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Coordinates only), velocity and acceleration, Numerical problems. FLUID DYNAMICS: Introduction, Equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation. Numerical problems. FLUID FLOW MEASUREMENTS: Applications of Bernoulli's equation, venturimeter, orifice meter, pitot-tube, vertical orifice and V-notch. Numerical problems.	09L+06T+10S	L1-L4
<u>Self-Study Component:</u> Identify the type of flow occurring in real engineering systems, industrial applications of flow measurement and applications of Bernoulli's Principle in Aerospace engineering.		
Unit 4		
FLOW THROUGH PIPES: Introduction, major and minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL. Numerical problems. LAMINAR FLOW AND VISCOUS EFFECTS: Reynold's number, critical Reynold's number, laminar flow through circular Pipe-Hagen Poiseuille's equation, laminar flow between parallel and stationary plates. Numerical problems.	08L+05T+10S	L1-L4
<u>Self-Study Component:</u> Fluid Flow in Oil and Gas Industries, Blood Flow Analysis Using Fluid Mechanics and Water Distribution Networks.		
Unit 5		
Flow past immersed bodies: Introduction, drag, lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness. Numerical problems. Compressible flow: Introduction – stagnation properties relationship, velocity of sound in a fluid, Mach number, Mach cone, propagation of pressure waves in a compressible fluid. Numerical problems. Introduction to Computational Fluid Dynamics (CFD): Necessity, limitations, philosophy behind CFD, applications; Commercial software's available for CFD analysis.	08L+05T=10S	L1-L4
<u>Self-Study Component:</u> Evaluate aerodynamic performance of engineering components, Aerodynamic Design of Electric Vehicles and Supersonic and Hypersonic Flight.		

Course Outcomes:	
After the completion of the course the student will be able to:	
1	Understand how a fluid is classified and define various properties of a fluid; understand Pascal's law and explain various types of manometers; and solve related numerical problems
2	Explain the total pressure and Centre of pressure acting on submerged surfaces; understand the concept of buoyancy, metacenter and metacentric height of floating and submerged bodies; and solve related numerical problems
3	Describe the types of fluid flow and understand the continuity, Euler and Bernoulli's equation; solve numerical problems related to fluid kinematics and dynamics; application of Bernoulli's equation.
4	Discuss Darcy and Chezy equations; describe Reynolds number and understand the derivation of flow through circular pipe, laminar flow between parallel and stationary plates; and solve related numerical problems
5	Understand the terms related to fluid flow past an immersed body; explain boundary layer, displacement, momentum and energy thickness; understand the relationship of stagnation properties applicable to compressible flow.

MAPPING OF COs WITH POs												
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	0	0	0	2	1	1	1	0	1
CO2	3	3	2	0	0	0	2	1	1	1	0	1
CO3	3	3	3	0	0	0	2	1	1	1	0	1
CO4	3	3	3	0	0	0	2	1	1	1	0	1
CO5	3	3	3	0	0	0	2	1	1	1	0	1
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												

Text Books.	
1	A Textbook of Fluid Mechanics and Hydraulic Machines (SI Units), Dr. R.K. Bansal, Laxmi Publications (P) Limited, Revised 9th Edition, 2010.
2	Fluid Mechanics: Fundamentals and Applications (SI Units), Yunus A. Cengel, JohnM.Cimbala. McGraw-Hill Publications (SIE), 3rd Edition, 2014.

Reference Text Books.	
1	Hydraulics and Fluid Mechanics including Hydraulic Machines, Dr. P.N. Modi and S.M. Seth, Rajsons Publications Private Limited, Standard Book House, 2009.
2	Fluid Mechanics, Frank M. White, McGraw-Hill Publications (SIE), 7th Edition, 2011.
3	A Text Book of Fluid Mechanics, R K Rajput, S Chand Publishers, 1998.

e-LEARNING RESOURCES

1	Fluid Mechanics: Mechanical Engineering Handbook, Kreith,F, Berger, S.A, et. al., Ed. Frank Kreith, Boca Raton: CRC Press LLC, 1999.
2	Videos and Lecture Notes: http://www.nptel.ac.in

LABORATORY SYLLABUS**PART - A**

1	Determination of discharge of a given pipe flow using orifice meter and venturi meter.
2	Calibration of rectangular notch and V notch.
3	Determination of friction factor in pipes.
4	Performance of types of turbines.
5	Determination of impact of jet on vanes.

PART - B

6	Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
7	a. Determination of Calorific value of solid, liquid and gaseous fuels. b. Determination of Viscosity of lubricating oil using Torsion viscometer.
8	Valve Timing diagram of 4-stroke IC Engine.
9	Performance Test on IC engines.
10	Performance Test on variable compression ratio IC Engine.

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks		Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	30		12
Laboratory components	Rubrics for experiment are added, then taken average	10	20	08
	Lab CIE	10		
TOTAL		50		20

Dr. Ambedkar Institute of Technology, Bengaluru - 560056

School of Core Engineering & Technology

Program: Aeronautical Engineering

Semester: III

Scheme: 2025

Academic Year: 2026-27

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Coordinator:

Mr. Bharath Kumar S,
Assistant Professor,
Aeronautical Engineering

Heads of Programme:

Dr. Kumara Thanaiah,
Assistant Professor,
Aeronautical Engineering

Head of School:

Dr. S Kavitha,
Professor,
School of Core Engineering and Technology, Dr. A.I.T

Course Title	ELEMENTS OF AERONAUTICS					
Course Code	1BAET305					
Course Category	PCC (Professional Core Course)					
Scheme and Credits	No. of Hours/Week					Credits
	L	T	P	S	TH/S	
	42	0	0	48	90	
Total no of contact hours	90					
Exam Duration: 03 Hrs.	Max. Marks: CIE+SEE = 50+50=100					
Pre-requisites	Basics of Physics, Fluid properties and Behaviors					

Course Learning Objectives:	
1	Introduce the history of aviation and basics components of Aircrafts
2	Appreciate and apply the basic principle of aviation
3	Impart the fundamentals of flight, aircraft structures & materials
4	Interpret aircraft propulsion system and its types based on thrust generation
5	Develop an understanding the dynamics of an aircraft along with its different systems

Syllabus	No. of hours	BTLs
Unit 1		
Introduction to Aircrafts & its materials: Introduction to Aircrafts: History of aviation; Atmosphere and its properties; Classification of aircrafts; Basic components of an aircraft; aircraft axis system; aircraft motions; control surfaces and high lift devices; conventional design configurations; principle of operation of each major part; Helicopters, their parts and functions. Aircraft Structures and Materials: Introduction; structural members; general types of construction; monocoque, semi-monocoque and geodesic structures; typical wing and fuselage structure; metallic and non-metallic materials for aircraft application.	8L+8S	L1-L4
<u>Self-Study Component:</u> Airplane evaluation & Practical applications. Characteristics and to Analyze materials, structures.		
Unit 2		
Basic principles of Flight: Basic principles of flight – significance of speed of sound; airspeed and groundspeed; standard atmosphere; Bernoulli's theorem and its application for generation of lift and measurement of airspeed; forces over wing section, airfoil nomenclature, pressure distribution over a wing section. Lift and drag components – generation of lift and drag; lift curve, drag curve, types of drag, factors affecting lift and drag; mass, center of gravity, center of pressure and its significance; aerodynamic center, aspect ratio, Mach number and supersonic flight effects; lift and drag based Numerical.	8L+10S	L1-L4
<u>Self-Study Component:</u> Importance of physics of flight (forces acting).		

Unit 3		
Aircraft Propulsion: Aircraft power plants, classification based on power plant and location and principle of operation. Turboprop, turbojet and turbofan engines; ramjets and scramjets; performance characteristics. Aircraft power plants – basic principles of piston, turboprop and jet engines; Brayton cycle and its application to gas turbine engines; use of propellers and jets for production of thrust; comparative merits and limitations of different types of propulsion engines; principle of thrust augmentation	8L+10S	L1-L4
<u>Self-Study Component:</u> Identify the physical properties aircraft power plants and its applications.		
Unit 4		
Aircraft Stability: Forces on an aircraft in flight; static and dynamic stability; longitudinal, lateral and roll stability; necessary conditions for longitudinal stability; basics of aircraft control systems. Effect of flaps and slats on lift, control tabs, stalling, gliding, landing, turning, aircraft maneuvers; stalling, gliding, turning. Simple problems on these. Performance of aircraft – power curves, maximum and minimum speeds for horizontal flight at a given altitude; effect of changes in engine power and altitude on performance; correct and incorrect angles of bank; aerobatics, inverted maneuvers, maneuverability. Numericals.	09L+10S	L1-L4
<u>Self-Study Component:</u> Interpret behavior of different aircraft Stability conditions performance factor.		
Unit 5		
Introduction to Aircraft Mechanical & Electrical Systems: Introduction to Aircraft Systems: Aircraft Mechanical systems – hydraulic and pneumatic systems and their applications; environment control system; fuel system, oxygen system Aircraft Electrical systems – flight control system, cockpit instrumentation and displays; communication systems; navigation systems; power generation systems – engine driven alternators, auxiliary power Module, ram air turbine; power conversion, distribution and management.	9L+10S	L1-L4
<u>Self-Study Component:</u> Evaluate various Aircraft Mechanical & Electrical Systems and its applications.		

Text Books.	
1	John D. Anderson, “Introduction to Flight”, McGraw-Hill Education, 8th edition, 2015
2	Lalit Gupta and O P Sharma “Fundamentals of Flight”, Vol-I to Vol-IV, Himalayan Books, 2006

Reference Text Books.	
1	A.C. Kermode, “Flight without formulae”, Pearson Education India, 1989
2	Nelson R.C., “Flight stability and automatic control”, McGraw-Hill International Editions, 1998
3	Ian Moir, Allan Seabridge, , “Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration”, John Wiley & Sons, 2011

e-LEARNING RESOURCES	
1	Videos and Lecture Notes: http://www.nptel.ac.in
2	https://skill-lync.com/ , https://aiaa.org/events-learning/online-education/
3	https://www.youtube.com/watch?v=amvrL0FU1ng

https://www.youtube.com/watch?v=B_p3_9si5D4 https://www.youtube.com/watch?v=xpOa3B03gYg https://www.digimat.in/nptel/courses/video/101104061/L01.html	https://www.youtube.com/watch?v=5uKmqP3kQ2A
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Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 Tests or CIE-3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes:

After the completion of the course the student will be able to:

1	Demonstrate how the History of aviation evolved and basics of aircraft structures
2	Apply and Explain the concepts of fundamentals of flight, basic principle of aviation
3	Explain the aircraft propulsion systems & distinguish the types of Engines and explain the principles of Rocket
4	Apply the static and dynamic conditions of the aircraft for different flying conditions.
5	Illustrate the aircraft mechanical & electrical systems depending on the requirement

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	2	2	2	-	-	-	-	-	1			
CO3	1	2	2	2	2	-	-	-	-	-	1			
CO4	1	2	2	2	2	-	-	-	-	-	1			
CO5	1	2	2	2	2	-	-	-	-	-	1			

Dr. Ambedkar Institute of Technology, Bengaluru - 560056

School of Core Engineering & Technology

Program: Aeronautical Engineering

Semester: III

Scheme: 2025

Academic Year: 2026-27

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1									
CO2									
CO3									
CO4									
CO5									

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1																	
CO2																	
CO3																	
CO4																	
CO5																	

Course Coordinator

Mr.A.Alagu Sundaram

Assistant Professor

Aeronautical Engineering Programme,
DrAIT

Head of Programme

Dr. Kumara Thanaiah

Associate Professor

Aeronautical Engineering Programme,
DrAIT

Head of School

Dr.S Kavitha

Professor

School of Core Engineering & Technology,
DrAIT

Course Title	AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES						
Course Code	1BAET306						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	3	3	42+0+0+48=90	3
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand Aircraft Material Requirements, properties required for aircraft materials, such as high strength-to-weight ratio, corrosion resistance, fatigue resistance, and temperature resistance.
CLO2	Identify and Classify Aircraft Materials, Differentiate between metallic materials (aluminum, titanium, steel, magnesium alloys) and non-metallic materials (composites, plastics, ceramics).
CLO3	Understand Composite Materials; Describe the structure, properties, manufacturing methods, and applications of composite materials used in aerospace engineering.
CLO4	Select Appropriate Materials, Apply material selection criteria for various aircraft components based on operational and environmental requirements.
CLO5	Understand Manufacturing Processes, conventional and advanced manufacturing processes used in aircraft production, including sheet-metal forming and Study Aircraft Component Fabrication.

SYLLABUS	No. of Hours	BTLs
UNIT 1	9	L1-L4
INTRODUCTION TO AIRCRAFT MATERIALS: Importance of materials in aerospace engineering, Classification of aircraft materials: Metallic and Non Metallic materials. Requirements of aerospace materials, Mechanical, physical and chemical properties. FERROUS MATERIALS: Iron and steel production, Plain carbon steels, Alloy steels, Stainless steels, Heat treatment of steels, Applications in aircraft structures and landing gear. NON-FERROUS MATERIALS: Aluminum and aluminum alloys, Magnesium alloys, Titanium alloys, Copper and nickel alloys, Super alloys for jet engines, Advantages and limitations.		
SELF-STUDY COMPONENTS: Ferrous and non-ferrous alloys, Polymers and elastomers, Ceramics and glasses, Composite materials, Smart and advanced materials.		
UNIT 2	9	L1-L4
HEAT TREATMENT AND SURFACE TREATMENT PROCESS: Introduction to heat treatment, types of heat treatments processes, Annealing, Normalizing, Hardening and tempering, Case hardening, Surface finishing methods, Anodizing and electroplating. CORROSION AND PREVENTION: Types of corrosion in aircraft Causes of corrosion, Corrosion inspection technique, Prevention and control methods Protective coatings and sealants.		
SELF-STUDY COMPONENTS: Phase transformations, Binary phase diagrams, Iron-carbon equilibrium diagram, Heat treatment of steels, Annealing, normalizing, hardening, and tempering.		

UNIT 3	9	L1-L4
COMPOSITES, PLASTICS AND RUBBER MATERIALS: Introduction to composites, classification of composites, Fiber-reinforced plastics, Carbon fiber composites, Glass fiber composites, Honeycomb structures, Advantages in modern aircraft, Composite repair techniques. Aircraft-grade wood, Adhesives and bonding materials, Thermoplastics and thermosetting plastics, Rubber materials and sealing applications Transparent materials (acrylics, polycarbonates).		
SELF-STUDY COMPONENTS: Definition and classification of composites, Matrix and reinforcement materials, Classification of plastics: Thermoplastics and thermosetting plastics Structure and properties of polymers, Definition and history of rubber, Classification of rubbers ,Natural rubber and its properties, Synthetic rubbers and their types.		
UNIT 4	9	L1-L4
SHEET METAL PROCESSES IN AIRCRAFT INDUSTRY: Sheet metal operations: shearing, punching, super plastic forming; operations in bending like stretch forming spinning drawing. Riveting, types and techniques, equipment, fasteners, integral tanks, final assembly of aircraft, Jigs and Fixtures, stages of assembly, aircraft tooling concepts.		
SELF-STUDY COMPONENTS: Definition and classification of sheet metals, Ferrous and non-ferrous sheet metals, Mechanical properties of sheet metals, Sheet metal standards, gauges, and specifications, Applications of sheet metals in engineering and aerospace industries.		
UNIT 5	9	L1-L4
ADVANCED AEROSPACE MATERIALS, MATERIAL TESTING AND INSPECTION: Introduction to advanced aerospace materials, Smart materials, Ceramic materials, Nano-materials, High-temperature materials, Future trends in aerospace materials. Destructive testing, Non-destructive testing (NDT): Ultrasonic testing, Radiographic testing, Magnetic particle inspection, Dye penetrant inspection, Quality control in aerospace manufacturing.		
SELF-STUDY COMPONENTS: Definition and characteristics of smart materials, Smart materials versus conventional materials, Classification of smart materials, Smart systems and smart structures.		

TEXT BOOKS:

1	Manufacturing Engineering and Technology, S. Kalpakjian, Steven R. Schmid, Addison Wesley, seventh Edition, 2014.
2	Aircraft production technology and management, ` S. C. Keshu, K. K Ganapathy, Interline Publishing House, Bangalore, 3rd Edition, 2022.

REFERENCE BOOKS:

1	Aircraft production technology, Douglas F. Horne, Cambridge University Press, 5 th Edition, 2020.
2	Materials Science and Engineering — William D. Callister

e-LEARNING RESOURCES:

1	Aviation Maintenance Technician Handbook — FAA
2	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each.

The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should not be included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1	2	3	4	5	6	7	8	9	10
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Understand the properties, characteristics, and applications of metallic and non-metallic materials used in aircraft structures and components.
CO2	Select appropriate materials for aircraft applications based on design requirements, operating conditions, and performance criteria.
CO3	Understand heat treatment, surface finishing, and corrosion protection methods used to enhance the performance and durability of aircraft materials.
CO4	Analyze the mechanical, physical, and environmental behavior of aircraft materials, including fatigue, creep, corrosion, and wear.
CO5	Apply knowledge of aircraft joining techniques, including riveting, welding, brazing, bolting, and adhesive bonding, in aircraft assembly.

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	0	0	0	2	1	1	1	0	1		
CO2	3	3	2	0	0	0	2	1	1	1	0	1		
CO3	3	3	3	0	0	0	2	1	1	1	0	1		
CO4	3	3	3	0	0	0	2	1	1	1	0	1		
CO5	3	3	3	0	0	0	2	1	1	1	0	1		

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	0	0	0	2	1	1	1	0			
CO2	3	3	2	0	0	0	2	1	1	1	0			
CO3	3	3	3	0	0	0	2	1	1	1	0			
CO4	3	3	3	0	0	0	2	1	1	1	0			
CO5	3	3	3	0	0	0	2	1	1	1	0			

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1										
CO2										
CO3										
CO4										
CO5										

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1																	
CO2																	
CO3																	
CO4																	
CO5																	

Course Coordinator**Head of Programme****Head of School**

Dr Ramprasad C, Assistant
Professor,
Aeronautical Engineering
Dr. A.I.T

Dr. Kumara Thanaiah, Assistant
Professor,
Aeronautical Engineering
Dr. A.I.T

Dr. S Kavitha,
Professor,
School of Core Engineering
and Technology, Dr. A.I.T

Course Title	Basics of MATLAB					
Course Code	1BAEL307A					
Course Category	AEC					
Scheme and Credits	No. of Hours/Week					Credits
	L	T	P	S	TH/S	
	0	0	28	2	30	
Total no. of contact hours	30 hours					
Exam Duration: 03 Hrs.	Max. Marks: CIE+SEE = 50+50=100					
Pre-requisites	Engineering Mathematics, Basic computer fundamentals and logical reasoning					

Course Learning Objectives:	
1	Understanding the MATLAB environment MATLAB
2	Being able to do simple calculations using
3	Being able to carry out simple numerical computations and analyses using MATLAB

UNIT No.	CONTENTS	No. of hours
1	MATLAB BASICS Introduction to MATLAB and its applications, MATLAB environment - Basic computer programming, Variables and constants, operators and simple calculations, Formulas, Scripts and functions, MATLAB toolboxes, Loops and conditional statements. PLOTTING Introduction to Plots –2D and 3D plots. MATRICES AND VECTORS Matrix and linear algebra review - Vectors and matrices in MATLAB - Matrix operations and functions in MATLAB, Array Operations.	15
2	MATLAB PROGRAMMING Relational and logical operators, Conditional statements, looping statements, Break and Continue statements, Reading and writing data, file handling, MATLAB scripts and functions (m-files), Toolbox structure (Aero toolbox), Data Import and Export (Excel and CSV files) (Real time programs) NUMERICAL METHODS Numerical solution of equations (fzero), Numerical Integration (trapz), Numerical Differentiation-Forward Difference, Backward Difference, Central Difference methods, Polynomial curve fitting (polyfit and polyval), Iterative methods-Newton–Raphson method, Gause Siedel method.	1

Course Outcomes:	
1	Develop MATLAB programs for engineering calculations using programming constructs, matrices, vectors, and file operations.
2	Analyze and visualize aeronautical engineering data using MATLAB plotting tools, matrix computations, and aerospace-related toolboxes.

3	Solve engineering and aerospace numerical problems using MATLAB-based numerical techniques and evaluate the accuracy of computational results.
Text Books	
1	Holly Moore, <i>MATLAB for Engineers</i> , 6th Edition, Pearson Education, 2022.
2	MATLAB: An introduction with application, Amos Gilat, 6 th edition, wiley publications.
3	William J. Palm III, <i>Introduction to MATLAB for Engineers</i> , 4th Edition, McGraw-Hill Education, 2020.
Reference Books	
1	Stormy Attaway, <i>MATLAB: A Practical Introduction to Programming and Problem Solving</i> , 5th Edition, Butterworth-Heinemann, 2022.
2	Delores M. Etter and David C. Kuncicky, <i>Introduction to MATLAB</i> , Pearson Education, Latest Edition.

Course Outcomes Mapping with Program Outcomes & Program Specific Outcomes.

Course Outcomes	Level of CO	Program Outcomes												Program specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	2	1	1	3							2	3	2	
CO2		3	2	2	3	3							2	3	2	
CO3		3	3	2	3	3							2	3	3	

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each.

The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has two components – CIE - theory component and CIE – laboratory component.

Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE.

Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Dr. Ambedkar Institute of Technology, Bengaluru - 560056

School of Core Engineering & Technology

Program: Aeronautical Engineering

Semester: III

Scheme: 2025

Academic Year: 2026-27

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Compute the deflection of simply supported beam and cantilever beam.
CO2	Verify Maxwell's theorem.
CO3	Determine the buckling load, shear failure and shear center.

Course Coordinator

Head of Programme

Head of School

Assistant Professor,
Aeronautical Engineering
Dr. A.I.T

Dr. Kumara Thanaiah, Assistant
Professor,
Aeronautical Engineering
Dr. A.I.T

Dr. S Kavitha,
Professor,
School of Core Engineering
and Technology, Dr. A.I.T

Course Title	BASIC ENGINEERING MATHEMATICS-I						
Course Code	1BMATDIP31						
Course Category	ASC (Applied Science Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	01	00	00	01	01	14+14=28	00
CIE Marks: 50			Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:

To develop a basic Mathematical knowledge required for higher semesters with few examples of its engineering applications.

SYLLABUS	No. of Hours	BTLs
UNIT 1	03	L1-L4
Differential Calculus: recapitulation of the concept of differentiation, product rule , quotient rule, chain rule, successive differentiation, differentiation of parametric functions, higher order derivatives, partial derivatives of first and second order.		
UNIT 2	02	L1-L4
Probability Theory: definition of probability, addition theorem, multiplication theorem (only statement), conditional probability and Baye's theorem.		
UNIT 3	03	L1-L4
Integral Calculus: recapitulation of the concept of Integration, integration by parts, substitution, definite integrals, reduction formulae (only statement).		
UNIT 4	02	L1-L4
Ordinary Differential Equations-I: order, degree, formation, Solution of homogeneous, Linear and Exact differential equations and its reductions.		
UNIT 5	04	L1-L4
Ordinary Differential Equations-II: Solutions of Linear differential equations of higher order with constant coefficients-inverse differential, operator method of undetermined coefficients.		

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition), Khanna Publishers, New Delhi.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill publications, New Delhi, 11th Reprint, 2010.

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Dr. Ambedkar Institute of Technology, Bengaluru - 560056

School of Core Engineering & Technology

Program: Aeronautical Engineering

Semester: III

Scheme: 2025

Academic Year: 2026-27

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	2							
CO2	3	2							
CO3	3	2							
CO4	3	1							
CO5	3	1							

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3													
CO2				3													
CO3				3													
CO4				3													
CO5				3													

Course Coordinators:

Dr. Divya Darshini S
Assistant Professor,
Mathematics, Dr. A.I.T

Dr. Latha D N
Assistant Professor,
Mathematics, Dr. A.I.T

Heads of Programme

Head of School

Dr. Shivaprassana G S,
Associate Professor,
Mathematics, Dr. A.I.T

Dr. Jambunath Baligar,
Professor,
School of Basic Sciences and Humanities,
Dr. A.I.T

Course Title	AEROTHERMODYNAMICS						
Course Code	1BAET401						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	0	3	42+28+0+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	To introduce fundamental concepts in thermodynamics concepts and laws in application to aerospace systems.
CLO2	Acquire the knowledge on first law of thermodynamics.
CLO3	Understand the concept of second law of thermodynamics and entropy.
CLO4	Understand the concept of pure substance and thermodynamic relations applicable to aerospace.
CLO5	Acquire the basic knowledge on gas power cycle and aerothermodynamics.

SYLLABUS	No. of Hours	BTLs
UNIT 1	8	L1-L4
FUNDAMENTAL CONCEPTS: Definition and scope of thermodynamics. Macroscopic vs. Microscopic approaches; Property: Intensive and extensive properties; Thermodynamic system - open and closed, Thermodynamic state, state point, path and process, quasi-static process, cyclic and non-cyclic processes. Thermodynamic equilibrium: definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Work, Modes of work. Concept of ideal gas and real gas, concept of temperature and heat.		
SELF-STUDY COMPONENTS: Basic understanding of statistical thermodynamics.		
UNIT 2	8	L1-L4
WORK, HEAT AND FIRST LAW OF THERMODYNAMICS: Energy Interaction: Work transfer definition, P-V displacement work for various process, Statement of the first law of thermodynamics; for a process and the cycle. Application to open and closed system; Steady and unsteady flow energy equation.		
SELF-STUDY COMPONENTS: Application of First Law of thermodynamics to any of the aircraft components.		
UNIT 3	9	L1-L4
SECOND LAW OF THERMODYNAMICS: Heat engine, heat pump and refrigerator. Equivalence of Kelvin Plank and Clausius statement; Reversed heat engine, schematic representation, coefficients of performance; Kelvin - Planck statement of the second law of thermodynamics; PMM I and PMM II, Reversible and Irreversible processes; Carnot engine, Carnot cycle.		
SELF-STUDY COMPONENTS: Application of Second Law of thermodynamics to any of the aircraft components.		
UNIT 4	9	L1-L4
PURE SUBSTANCES & IDEAL GASES: Mixture of ideal gases and real gases, ideal gas equation, compressibility factor use of charts. PT and P-V diagrams, triple point and critical points. Sub-cooled liquid, Saturated liquid, mixture of saturated		

liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams.		
SELF-STUDY COMPONENTS: Aircraft icing and de-icing mechanism.		
UNIT 5	8	L1-L4
GAS POWER CYCLES: Gas Power Cycles: Air standard efficiency, Otto cycle, Diesel cycle, Dual Cycle, Mean-effective pressure, Brayton cycle; Reheat and Regenerative cycle, Aero-Thermodynamics: Introduction; Aero-thermodynamics for space vehicles; Thermal surface effects; Flight environment. Psychrometric properties and process.		
SELF-STUDY COMPONENTS: Understand thermal, propulsive and overall efficiencies.		

TEXT BOOKS:	
1	Cengel, Y. A. and Boles, M. A., Thermodynamics: An Engineering Approach, 10 th ed., McGraw-Hill, 2024.
2	Nag, P. K., Engineering Thermodynamics, 7 th ed., Tata McGraw-Hill, 2025.
3	Sonntag, R.E., Borgnakke, C. and Van Wylen, G.J. Fundamentals of Thermodynamics, 11 th ed., Wiley, 2024.

REFERENCE BOOKS:	
1	Rogers, G. F. C. and Mayhew, Y. R., Engineering Thermodynamics: work and heat transfer, 4th ed., Longman, 1992.
2	Hill, P.G. and Peterson, C.R., 1992. Mechanics and Thermodynamics of Propulsion, Pearson Education, 2009.
3	Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. B., Principles of Engineering Thermodynamics (SI Version), 8 th ed., Wiley, 2015
4	Spalding, D. B. and Cole, E. H., Engineering Thermodynamics, 3 rd ed., Edward Arnold, 1973.
5	Jones, J. B. and Dugan, R. E., Engineering Thermodynamics, Prentice Hall, 1996
6	Rayner Joel, Basic Engineering Thermodynamics, 5 th ed., Addison Wesley, New York, 1996.
7	Rathakrishnan. E, Fundamentals of Engineering Thermodynamics, Prentice –Hall, India, 2000.
8	Hirschel, E.H., Basics of Aerothermodynamics, 2005.
DATA HAND BOOK	
1. Thermodynamics Data Book , B T Nijaguna and B S Samaga, Sudha Publishers, 2016.	

Assessment Details both (CIE and SEE)
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Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1																	
CO2																	
CO3																	
CO4																	
CO5																	

Course Coordinator
Dr. Kumara Thanaiah
Associate Professor
Aeronautical Engineering
Programme, DrAIT

Head of Programme
Dr. Kumara Thanaiah
Associate Professor
Aeronautical Engineering
Programme, DrAIT

Head of School
Dr.S Kavitha
Professor
School of Core Engineering &
Technology, DrAIT

Course Title	AIRCRAFT PROPULSION						
Course Code	1BAEU402						
Course Category	IPCC (Integrated Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	2	3	4	42+0+28+50=120	4
CIE Marks: 50	SEE Marks:50		Total Max. Marks: 100			Duration of SEE: 03 Hrs.	

Course Learning Objectives:	
CLO1	Understand the basic principle and theory of aircraft propulsion.
CLO2	Acquire knowledge of importance of nozzles & inlets
CLO3	Understand the purpose of centrifugal and axial compressors of jet engine.
CLO4	Acquire the knowledge on combustion chamber.
CLO5	Understand the purpose of centrifugal and axial turbine of jet engine.

SYLLABUS	No. of Hours	BTLs
UNIT 1	9	L1-L3
FUNDAMENTALS OF AIRCRAFT PROPULSION Review of thermodynamic principles, Illustration of the working of gas turbine engine; The thrust equation; Factors affecting thrust; jet Engine basic performance parameters. Thermodynamic cyclic analysis of jet engine.		
SELF-STUDY COMPONENTS: Study recent advancements in sustainable aviation fuels, hybrid-electric propulsion systems, hydrogen-powered aircraft, engine emissions reduction technologies, and future propulsion concepts.		
UNIT 2	9	L1-L4
INLETS AND NOZZLES Subsonic Inlets: Internal flow and Stall in Subsonic inlets, Boundary layer separation. Major features of external flow near a subsonic inlet. Relation between minimum area ratio and external deceleration ratio. Diffuser performance. Supersonic inlets: Starting problem in supersonic inlets, Shock swallowing by area variation, External deceleration. Modes of inlet operation. Nozzles: Theory of flow in isentropic nozzles, Nozzle and its types and nozzle choking, Nozzle throat conditions. Nozzle efficiency, Losses in nozzles. Over-expanded and under-expanded nozzles, Ejector and variable area nozzles, Thrust reversal.		
SELF-STUDY COMPONENTS: Study advanced inlet and nozzle technologies, thrust vectoring, stealth designs, CFD analysis, additive manufacturing, icing effects, and noise reduction		
UNIT 3	9	L1-L4
COMPRESSORS Elementary theory of axial flow compressor, Velocity triangles, Degree of reaction, three-dimensional flow. Pressure Ratio, Surge, Choke & Stall, Air angle distribution for free vortex and constant reaction designs, Compressor blade design. Axial compressor performance characteristics. Principle of operation of centrifugal compressors.		

SELF-STUDY COMPONENTS: Study modern compressor technologies, advanced blade materials, variable geometry mechanisms, computational design methods, efficiency improvement techniques, and applications.

UNIT 4**9****L1-L4****COMBUSTION CHAMBERS**

Classification of combustion chambers, important factors affecting combustion chamber design, Combustion process, Combustion chamber performance, Swirlers & Atomizers. Effect of operating variables on performance – Flame tube cooling – Flame stabilization – Use of flame holders.

SELF-STUDY COMPONENTS:

Study recent advancements in low-emission combustor technologies, alternative aviation fuels, combustion instability control methods, and sustainable aero-engine development.

UNIT 5**9****L1-L4****TURBINES**

Introduction, Turbine stage, multi-staging of turbine, Exit flow conditions, Turbine cooling, Heat transfer in turbine cooling. Principle of operation of radial turbines.

SELF-STUDY COMPONENTS: Study recent advancements in turbine blade materials, additive manufacturing techniques, digital engine monitoring systems, and sustainable aviation propulsion technologies.

Syllabus**PART: A - CONVENTIONAL EXPERIMENTS**

1	Conduct an experiment to study the construction, components, and operating principles of aircraft Piston engines.
2	Conduct an experiment to study the construction, components, and operating principles of aircraft Jet engines.
3	Perform an experiment to evaluate the laminar burning velocity of a premixed flame.
4	Conduct an experiment to evaluate the performance characteristics and efficiency of a propeller at various rotational speeds.
5	a) Conduct an experiment to study the characteristics of Free & Forced convective heat transfer over a flat plate.
6	Preparation of a solid propellant.
7	Computation of burning rate of the propellant.
8	Determine the calorific value of liquid fuel.
9	Performance study of hybrid motor using a thrust stand.
10	Analysis of grain stress and strain of a solid propellant.

PART: B - TYPICAL OPEN-ENDED EXPERIMENTS

1	Conduct the experiment to determine and analyze the pressure distribution and velocity variation along a convergent nozzle.
2	Perform the Free & Wall jet experiment and measure the velocity distribution across the jet for various flow speeds.
3	Conduct an experiment to study the pressure distribution across an axial-flow compressor blade row at various incidence angles and determine the static pressure rise across the blade row.
4	Conduct an experiment to study the pressure distribution across an axial-flow turbine

TEXT BOOKS:	
1	Aircraft propulsion, Bhaskar Roy, Elsevier, (ISBN-13): 978-8131214213, 2011
2	Gas Turbines, V. Ganesan, Tata McGraw-Hill, 3rd Edition, ISBN-13: 978-0070681927, 2017

REFERENCE BOOKS:	
1	Hill, P.G. & Peterson, C.R. , “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999, ISBN-13: 978-0201146592
2	Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. , “Gas Turbine Theory”, 7th Edition, Longman, 2019, ISBN-13: 978-9389342215.
3	S. M. Yahya , “Fundamentals of Compressible Flow with Aircraft and Rocket propulsion”, 7th Edition, New Age International Publications, New Delhi 2023, ISBN-13: 978-9395161715
4	Irwin E. Treager , “Gas Turbine Engine Technology” GLENCOE Aviation Technology Series, 3 rd Edition, Tata McGraw Hill Publishing Co. Ltd. Print 2017, ISBN-13: 978-1259064876

e-LEARNING RESOURCES:	
1	http://nptel.ac.in/courses/101106033/
2	http://nptel.ac.in/courses/101101001/
3	http://nptel.ac.in/courses/101101002/
4	http://nptel.ac.in/courses/101104019/

Assessment Details both (CIE and SEE)				
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.				
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks		Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	30		12
Laboratory components	Rubrics for experiment are added, then taken average	10	20	08
	Lab CIE	10		
TOTAL		50		20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Apply the principles of thermodynamics to aircraft propulsion.
CO2	Calculate the operating characteristics of inlets and nozzles
CO3	Estimate the performance of the compressor in a gas turbine engine.
CO4	Describe the mechanics of combustion chamber in a gas turbine engine.
CO5	Analyze the performance of radial and axial flow turbines

Mapping of CO's, PO's with PSO's**Strength of correlation:** Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	0	0	0	0	0	0	2	2	0	3	2	1
CO2	3	3	0	0	0	0	0	0	2	2	0	3	3	2
CO3	3	3	0	0	0	0	0	0	2	2	0	3	3	2
CO4	3	3	0	0	0	0	0	0	2	2	0	3	2	2
CO5	3	3	0	0	0	0	0	0	2	2	0	3	3	2

Mapping of CO's with Knowledge and Attitude Profile (WK)**Strength of correlation:** Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	3	2	2	1	0	1	1	0
CO2	2	3	3	3	2	1	2	1	1
CO3	2	3	3	3	3	2	2	1	1
CO4	2	3	2	3	2	2	2	2	1
CO5	2	3	3	3	2	2	3	2	1

Mapping of CO's with Sustainable Development Goals (SDG)**Strength of correlation:** Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	0	2	0	0	1	1	3	0	0	1	2	0	0	0	1
CO2	0	0	0	2	0	0	1	1	3	0	0	2	2	0	0	0	1
CO3	0	0	0	2	0	0	2	2	3	0	0	2	2	0	0	0	1
CO4	0	0	1	2	0	0	2	1	3	0	0	3	3	0	0	0	1
CO5	0	0	1	2	0	0	2	2	3	0	0	3	3	0	0	0	1

Coordinators:

Course Coordinators:

Mr. Balaraja N C,
Assistant Professor,
Aeronautical Engineering

BOS Coordinators:

Mr. Alagu Sundaram A,
Assistant Professor,
Aeronautical Engineering

Heads of Programme

Dr. Kumara Thanaiah,
Associate Professor,
Aeronautical Engineering

Head of School

Dr. S Kavitha,
Professor,
School of Core Engineering and Technology, Dr. A.I.T

Course Title	AERODYNAMICS					
Course Code	1BAET403					
Course Category	PCC (Professional Core Course)					
Scheme and Credits	No. of Hours/Week					Credits
	L	T	P	S	TH/S	
	42	28	0	50	120	4
Total no of contact hours	120					
Exam Duration: 03 Hrs.	Max. Marks: CIE+SEE = 50+50=100					
Pre-requisites	Physics, Mathematics Fluid properties & behavior					

Course Learning Objectives:	
1	Understand the low speed flows & airfoil characteristics
2	Determine two-dimensional flow over circular cylinder and airfoil
3	Summarize the compressible flow & different types shock waves
4	Apply Prandtl – Meyer relation, shocks interaction and expansion
5	Interpret wind tunnel model testing, balancing and measurements

Syllabus	No. of hours	BTLs
Unit 1		
Introduction to Low-Speed Flow: Properties of fluids and classifications. Dimensionless number and applications for fluid flow. Mach number regimes-boundary layer concept. Control volume approach to Continuity, momentum and energy equation. Airfoil & Wing Characteristics: Fundamental aerodynamic variables: Airfoil nomenclature, NACA airfoil characteristics. Various wing planform geometry, Analyze aerodynamic forces and moments, Centre of Pressure, Pressure Coefficient, Aerodynamic Center and Center of Gravity. Bernoulli's theorem and applications-Numericals. Calculation of airfoil lift and drag from measured surface pressure distributions, typical airfoil aerodynamic characteristics at low speeds.	8L+10S	L1-L4
<u>Self-Study Component:</u> Practical applications of fluid properties- apply Airfoil Characteristics and to Analyze aerodynamic forces and moments.		
Unit 2		
Two Dimensional Flows: Incompressible Flow Over circular cylinder: Uniform flow, Source flow, Sink flow, Combination of a uniform flow with source and sink. Doublet flow, Vortex flow. Flow Separation: Non-lifting flow over a circular cylinder -Lifting flow over a circular cylinder-Numericals. Kutta-Joukowski theorem and generation of lift. Incompressible flow over airfoils: Kelvin's circulation theorem and the starting vortex, vortex sheet. Kutta condition, Classical thin airfoil theory for symmetric and cambered airfoils-Numericals.	08L+10S	L1-L4
<u>Self-Study Component:</u> Importance flow separation over circular cylinder and airfoils for lift generation-Applications of Aerospace design.		

Unit 3		
One Dimensional Compressible Flow: Conservation laws of physics: conservation of mass, momentum, energy and state equations, velocity of sound, Adiabatic steady state flow equations, Flow through Nozzles: converging, diverging and converging-diverging- Numericals. Performance under various back pressure. Normal Shock: Shock wave and its applications. Prandtl Meyer equation and Rankine – Hugoniot relation, Normal shock equations: Property ratios in terms of upstream Mach number, Moving Normal Shock wave - shock wave Numericals.	09L+10S	L1-L4
<u>Self-Study Component:</u> Identify the type of flow through Nozzles-analyze performance under various back pressure and Formation of Shocks and applications.		
Unit 4		
Oblique shocks and Expansion waves: Oblique shock wave equations from corresponding Normal shock relation, Pitot static tube corrections for subsonic and supersonic flows, Hodograph and pressure turning angle. Flow past wedges and concave corners, strong, weak, attached and detached shocks. Prandtl – Meyer expansion function, reflection and interaction of shocks. Expansion waves – Numericals. Effect of aerodynamic heating and prediction during high speed flow. Linearized Flow: Small Perturbation Potential Theory, Linearized Subsonic and Supersonic Pressure Co-efficient, Mach waves and Mach angles.	09L+10S	L1-L4
<u>Self-Study Component:</u> Interpret behavior of Oblique shocks and Expansion wave.		
Unit 5		
Experimental Aerodynamics: Wind tunnel and its Components-types. wind tunnel: model balancing, testing & force measurements. wind tunnel measurements: Pressure-Temperature- Velocity- Intrusive & Non-Intrusive. Fluid flow visualization techniques: Subsonic and supersonic flow (Smoke, Tufts and oil spill) - Optical methods: Schlieren and Shadowgraph techniques.	08L+10S	L1-L4
<u>Self-Study Component:</u> Evaluate aerodynamic design performance of different model by using Wind tunnel at various Mach number.		

Course Outcomes:	
After the completion of the course the student will be able to:	
1	Understand how a fluid is classified and define various properties of a fluid airfoil characteristics solve related numerical problems
2	Apply the concept of two-dimensional flow over circular cylinder and airfoil
3	Describe the compressible flow and different shock waves and solve numerical
4	Identify Oblique shock waves, Prandtl – Meyer expansion function and solve related numerical problems
5	Understand the wind tunnel and its applications-model balancing, testing and measurements

MAPPING OF COs WITH POs											
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	0	0	0	0	1	0	0	2	0
CO2	3	2	0	0	0	0	1	0	0	2	0
CO3	3	2	0	0	0	0	1	0	0	2	0
CO4	3	2	0	0	0	0	1	0	0	2	0
CO5	3	2	0	0	0	0	1	0	0	2	0
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0											

Text Books.	
1	Fundamental of Aerodynamics, Anderson J.D, McGraw-Hill International Edition, New York, 5th edition,2011
2	Rathakrishnan, E., “Gas Dynamics”, 6th Edition, Prentice Hall of India, 2017
3	Aerodynamics for Engineering Students, E. L. Houghton, P.W. Carpenter, Elsevier, New York, 5th edition,2010.

Reference Text Books.	
1	Aerodynamics, Clancy L. J., Sterling book house, New Delhi,2006
2	Theoretical Aerodynamics, Louis M. Milne- Thomson, Dover Publications, USA, Imported Edition, 2011.
3	V. Babu, “Fundamentals of Gas Dynamics”, 2nd Edition, John Wiley & Sons Ltd, (2015)
e-LEARNING RESOURCES	
1	Videos and Lecture Notes: http://www.nptel.ac.in
2	https://skill-lync.com/ , https://aiaa.org/events-learning/online-education/

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass.

CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE.

SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE-1 and CIE-2 Tests or CIE-3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	

1. Two full questions (each of 20 Marks) are to be set from each unit.

2. Student shall answer five full questions selecting one full question from each unit.

Course Coordinator

Mr.A.Alagu Sundaram

Assistant Professor

Aeronautical Engineering Programme,
DrAIT**Head of Programme**

Dr. Kumara Thanaiah

Associate Professor

Aeronautical Engineering Programme,
DrAIT**Head of School**

Dr.S Kavitha

Professor

School of Core Engineering & Technology,
DrAIT

Course Title	AIRCRAFT STRUCTURES						
Course Code	1BAET404						
Course Category	PCC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	1	0	3	4	42+28+0+50=120	4
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Comprehend the basic concepts of stress and strain.
CLO2	Acquire the knowledge of types of loads on aerospace vehicles.
CLO3	To introduce shear flow analysis in open and closed section beams with an emphasis on thin-walled structures.
CLO4	To provide insights into structural idealization techniques and their application to various aircraft structural components.
CLO5	To enable students to analyze stress distribution in aircraft components such as wings and fuselage under bending, shear, and torsional loads.

SYLLABUS	No. of Hours	BTLs
UNIT 1	9	L1-L4
Static Strength: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, and Distortion energy theory, failure of brittle and ductile materials, Stress concentration, and Determination of Stress concentration factor. Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia. Fatigue Strength: Introduction, S-N Diagram, modifying factors: size effect, surface effect, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.		
<u>SELF-STUDY COMPONENTS:</u> Aircraft design and material strength concepts needed to master aeronautical component behavior under static, impact, and fatigue loads.		
UNIT 2	8	L1-L4
Loads on Aircraft: Structural nomenclature, Types of loads, load factor, Aerodynamics loads, Symmetric manoeuvre loads, Velocity diagram, Function of structural components. Buckling of Columns : Introduction, Critical Load, Euler's Critical Load for various end conditions, Slenderness ratio, Rankine's Crippling Load		
<u>SELF-STUDY COMPONENTS:</u> Independently master the fundamental principles governing aircraft structural loading environments and the mechanical stability criteria. Bridge the gap between aerodynamic force generation and mechanical column failure to evaluate the safety envelope of aerospace vehicles.		
UNIT 3	9	L1-L4
Shear Flow in Open & Closed Sections: Open Sections: Concept of shear flow, Shear Flow in Thin walled beams, the shear centre and Elastic axis. Closed Sections: Bredt - Batho theory, shear centre of closed sections		
<u>SELF-STUDY COMPONENTS:</u> Develop an advanced engineering capability in analyzing thin-walled structures typical of aircraft wings, fuselages, and spacecraft hulls.		
UNIT 4	8	L1-L4

Structural Idealization and Stress analysis of aircraft components: Structural idealization Principle, Idealization of a panel. Bending of open and closed section idealized beams, shear of open section and closed section idealized beams.		
SELF-STUDY COMPONENTS: Calculate localized boom stress profiles under multi-axis pure bending forces.		
UNIT 5	8	L1-L4
Stress analysis of aircraft components: Wing spars and box beams, Bending, Shear and Torsion of fuselage section, Bending, Shear and Torsion of wing section.		
SELF-STUDY COMPONENTS: Solve a step-by-step numerical problem to find the torsional shear flow in a two-cell wing box and map the continuous shear flow distribution around a circular fuselage		

TEXT BOOKS:	
1	T.M.G Megson, 'Aircraft Structures for Engineering Students', Edward Arnold, 1995.
2	Timoshenko and Goodier, 'Theory of Elasticity', McGraw Hill Co.

REFERENCE BOOKS:	
1	B.K. Donaldson, "Analysis of Aircraft Structures – An Introduction", McGraw-Hill, 1993.
2	D.J. Peery, and J.J. Azar, "Aircraft Structures", 2nd edition, McGraw, Hill, N.Y., 1993.
3	E.H. Bruhn, "Analysis and Design of Flight Vehicles Structures", Tri – state off set company, USA, 1985.
e-LEARNING RESOURCES:	
1	https://nptel.ac.in/courses/101105332

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)

Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Apply the basic concepts of stress and strain analysis.
CO2	Understand and develop solutions to analyse the structures response to load.
CO3	Analyze shear flow in open and closed sections, particularly focusing on thin-walled beams.
CO4	Applying the Structural Idealization to various structural components of an aircraft.
CO5	Analyze stress for wings and fuselage components in aircraft.

Mapping of CO's, PO's with PSO's**Strength of correlation:** Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	0	0	0	2	1	1	1	0	2	0	0
CO 2	3	3	3	0	0	0	2	1	1	1	0	2	0	0
CO 3	3	3	3	0	0	0	2	1	1	1	0	2	0	0
CO 4	3	3	3	0	0	0	2	1	1	1	0	2	0	0
CO 5	3	3	3	0	0	0	2	1	1	1	0	2	0	0

Course Coordinator:**Heads of Programme:****Head of School:**

Mrs. Archana M,
Assistant Professor,
Aeronautical Engineering

Dr. Kumara Thanaiah,
Assistant Professor,
Aeronautical Engineering

Dr. S Kavitha,
Professor,
School of Core Engineering and
Technology, Dr. A.I.T

Course Title	AIRCRAFT STRUCTURES LABORATORY						
Course Code	1BAEL405						
Course Category	PCCL (Professional Core Course Laboratory)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	0	0	28	2	30	30	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Learn about the simply supported beam, cantilever beam.
CLO2	Understand Maxwell's theorem and Poisson ratio.
CLO3	Acquire the knowledge about buckling load, shear failure and shear center.

Syllabus	
PART: A - CONVENTIONAL EXPERIMENTS	
1	Deflection of a Simply Supported Beam.
2	Deflection of a cantilever Beam
3	Beam with combined loading by using superposition theorem
4	Verification of Maxwell's Reciprocal Theorem.
5	Determination of Young's Modulus using strain gages.
6	Poisson Ratio Determination.
PART: B - TYPICAL OPEN-ENDED EXPERIMENTS	
Open-ended experiments are a type of laboratory activity where the outcome is not predetermined, and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.	
1	Impact testing
2	UTM Testing
3	Buckling load of slender Eccentric Columns and Construction of Southwell Plot.
4	Shear Failure of Bolted and Riveted Joints.

Teaching & Learning Process (Innovative Delivery Methods):	
1	Active Learning Techniques
2	Problem-Based Learning (PBL)
3	Team-Based Learning (TBL)
4	Hands-On Experiments and Simulations

Assessment Details both (CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.

****Self-Study Component should be not included for SEE & CIE.**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Outcomes: After the completion of the course, the student will be able to:

CO1	Compute the deflection of simply supported beam and cantilever beam.
CO2	Verify Maxwell's theorem.
CO3	Determine the buckling load, shear failure and shear center.

Mapping of CO's, PO's with PSO's

Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	0	0	0	0	0	1	0	0	2	1	0
CO 2	3	3	3	0	0	0	0	0	1	0	0	2	1	0
CO 3	3	3	3	0	0	0	0	0	1	0	0	2	1	0

Course Coordinator:**Heads of Programme:****Head of School:**

Mrs. Archana M,
Assistant Professor,
Aeronautical Engineering

Dr. Kumara Thanaiah,
Assistant Professor,
Aeronautical Engineering

Dr. S Kavitha,
Professor,
School of Core Engineering and
Technology, Dr. A.I.T

MAPPING OF COs WITH POs												
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	0	0	0	2	1	1	1	0	1
CO2	3	3	2	0	0	0	2	1	1	1	0	1
CO3	3	3	3	0	0	0	2	1	1	1	0	1
CO4	3	3	3	0	0	0	2	1	1	1	0	1
CO5	3	3	3	0	0	0	2	1	1	1	0	1
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0												

Text Books.	
1	Chua C.K., Leong K.F., and Lim C.S., <i>Rapid Prototyping: Principles and Applications</i> , World Scientific Publishing.
2	Ian Gibson, David Rosen, and Brent Stucker, <i>Additive Manufacturing Technologies</i> , Springer.
3	Ali K. Kamrani and Emad Abouel Nasr, <i>Rapid Prototyping: Theory and Practice</i> , Springer.

Reference Text Books.	
1	Andreas Gebhardt, <i>Understanding Additive Manufacturing</i> , Hanser Publications
2	Liou and Liou, <i>Rapid Prototyping and Engineering Applications</i> , CRC Press.
e-LEARNING RESOURCES	
1	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details both (CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.			
CONTINUOUS INTERNAL EVALUATION (CIE)		Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)
Laboratory components	Rubrics for each experiment are added, then taken average	30	20
	Lab CIE	20	
TOTAL		50	20

Course Coordinators

Byregowda K C,
Assistant Professor,
Mechanical Engineering

Dr. Saravanan P,
Assistant Professor,
Civil Engineering

Dr Ramprasad C,
Assistant Professor,
Aeronautical Engineering

Head of School

Dr. S Kavitha,
Professor,
School of Core Engineering and Technology, Dr. A.I.T

Course Title	BASIC ENGINEERING MATHEMATICS-II						
Course Code	1BMATDIP411						
Course Category	ASC (Applied Science Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	03	00	00	02	03	14+0+0+14=28	00
CIE Marks: 100			Total Max. Marks: 100				

Course Learning Objectives:

To develop a basic Mathematical knowledge required for higher semesters with few examples of its engineering applications.

SYLLABUS	No. of Hours	BTLs
UNIT 1	03	L1-L4
Linear Algebra: Introduction, Rank of a matrix by elementary row operations, consistency of system of linear equations.		
UNIT 2	02	L1-L4
Complex functions: Recapitulation of the concept of complex numbers, complex functions involving two variables, differentiation of complex functions.		
UNIT 3	03	L1-L4
Vector calculus: Recapitulation of the concept of vectors, scalar point and vector point functions, gradient, divergence and curl, vector integration.		
UNIT 4	03	L1-L4
Beta and Gamma functions: Definitions, equivalent forms of Beta and Gamma functions (no derivations), standard relation in Beta and Gamma functions, simple problems.		
UNIT 5	03	L1-L4
Laplace transforms: Definitions, standard results, shifting property, multiplication by t^n , division by t (no derivations): simple problems.		

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition), Khanna Publishers, New Delhi.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill publications, New Delhi, 11th Reprint, 2010

[illegible]

Mapping of CO's with Knowledge and Attitude Profile (WK)									
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0									
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	3	2							
CO2	3	2							
CO3	3	2							
CO4	3	1							
CO5	3	1							

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1				3													
CO2				3													
CO3				3													
CO4				3													
CO5				3													

Course Coordinators:

Dr. Divya Darshini S
Assistant Professor,
Mathematics, Dr.AIT

Dr. Latha D N
Assistant Professor,
Mathematics, Dr.AIT

Heads of Programme

Dr. Shivaprassana G S,
Associate Professor,
Mathematics, Dr.AIT

Head of School

Dr. Jambunath Baligar,
Professor,
School of Basic Sciences and Humanities,
Dr. A.I.T

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Core Engineering & Technology
Program: Aeronautical Engineering

Semester: IV

Scheme: 2025

Course Title	BIOLOGY FOR AERONAUTICAL ENGINEERS						
Course Code	1BBIT407A						
Course Category	BSC (Professional Core Course)						
Teaching - Learning Scheme & Credit	L	T	P	S	Total	Total Teaching Hours	Credit
	3	0	0	3	3	45+0+0+45=90	02
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hrs	

Course Learning Objectives:	
CLO1	Understand the basic concepts and principles of bio-inspired systems and biomimicry.
CLO2	Analyse bird flight, wing design, and other biological mechanisms relevant to aerospace engineering.
CLO3	Understand bio-inspired technologies such as bird-inspired UAVs, morphing aircraft, honeycomb structures, and bio-inspired robots.
CLO4	Explain how biological structures and mechanisms inspire engineering solutions.
CLO5	Apply biological principles to develop innovative and efficient solutions for aeronautical engineering problems.

SYLLABUS	No. of Hours	BTLs
UNIT 1	09	L1-L4
Fundamentals of Bio-Inspiration: Biomimicry and biomimetics: Core concepts, Real-World Examples. Bio-inspired engineering: Robotics, Materials, Transportation, Medicine. Nature as a source of engineering solutions: Nature-Based Solutions for the Environment, Biological structures and functions: Advantages and limitations of bio-inspired design.		
SELF-STUDY COMPONENTS: Principles of learning from nature, Real-world engineering examples.		
UNIT 2	09	L1-L4
Bio-Inspired Aerodynamics: Bird flight and wing design: Introduction, Structure of a Bird's Wing, Birds Generate Lift, Birds Generate Thrust, Flapping Motion, Wing Shape and Flight Performance, Wing Morphing, Aspect Ratio, Wing Loading, Bird Flight Modes, Insect flight, Flapping-wing mechanisms, Wing morphing, Lift and drag inspired by biological systems.		
SELF-STUDY COMPONENTS: Wing morphology, Flapping flight, Bird-inspired aerodynamic designs.		
UNIT 3	09	L1-L4
Bio-Inspired Aircraft & UAVs: Bird-inspired UAVs: Principle of Bird-Inspired UAVs, Types of Bird-Inspired UAVs, Working of a Bird-Inspired UAV, Major Components, Wing Flapping Mechanism, Advantages of Bird-Inspired UAVs, Limitations, Applications, Bird-Inspired UAV vs Conventional UAV. Insect-inspired micro air vehicles, Morphing aircraft: Types of Morphing, Working Principle, Major Components, Smart Materials Used, Advantages, Limitations, Applications, Bio-inspired propulsion, Bio-inspired flight control, Applications in drones and aerospace.		

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Core Engineering & Technology
Program: Aeronautical Engineering

Semester: IV

Scheme: 2025

SELF-STUDY COMPONENTS: Ornithopters, Flapping-wing UAVs, Applications of bio-inspired drones.		
UNIT 4	09	L1-L4
Bio-Inspired Materials & Structures: Lightweight biological structures, Bone-inspired structures , Honeycomb structures: Biological Inspiration, Why Hexagonal Shape?, Construction, Working Principle, materials used, applications, advantages and limitations, Spider-silk-inspired material , Shark-skin-inspired surfaces , Lotus-leaf-inspired surfaces Self-cleaning and super hydrophobic surfaces.		
SELF-STUDY COMPONENTS: Bee-honeycomb inspiration, Lightweight aerospace structures, Sandwich panels.		
UNIT 5	09	L1-L4
Bio-Inspired Robotics & Intelligent Systems: Bio-inspired robots: Basic Principle, Types of Bio-Inspired Robots, Insect-Inspired Robots, Snake-Inspired Robots, Fish-Inspired Robots, Components of Bio-Inspired Robots , Robotic birds/insects , Neural-network-inspired control , Swarm intelligence, Bio-inspired navigation and optimization, Aerospace applications.		
SELF-STUDY COMPONENTS: Locomotion mechanisms, Aerospace and exploration applications.		

TEXTBOOKS:	
1	Biomimicry: Innovation Inspired by Nature — Janine M. Benyus
2	Biologically Inspired Robotics — J. Ayers, J. W. Davis & A. Rudolph

REFERENCE BOOKS:	
1	Biomimetic and Bio-Inspired Materials and Design — Y. Bar-Cohen
2	Bio-Inspired Flight: A Comprehensive Review — useful reference material for bird/insect flight and flapping-wing UAVs .
E-LEARNING RESOURCES:	
1	Videos and Lecture Notes: http://www.nptel.ac.in

Assessment Details both (CIE and SEE)		
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. CIE: The CIE has three components – CIE - theory component, assignment and group activity. Students have to score a minimum of 40% Marks in the total of CIE - theory, assignment and group activity components put together to take SEE. SEE: Theory Semester End Exam (SEE) is conducted for 50 marks (3 Hours duration) and reduced to 50 Marks. **Self-Study Component should be not included for SEE & CIE.		
CONTINUOUS INTERNAL EVALUATION (CIE)	Max. Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Core Engineering & Technology
Program: Aeronautical Engineering

Semester: IV

Scheme: 2025

Theory	Weightage of CIE1 and CIE2 Tests or CIE3	50	20
TOTAL		50	20

QUESTION PAPER PATTERN (SEE)										
Q. No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
UNIT	1		2		3		4		5	
1. Two full questions (each of 20 Marks) are to be set from each unit.										
2. Student shall answer five full questions selecting one full question from each unit.										

Course Outcomes: After the completion of the course, the student will be able to:	
CO1	Explain the basic concepts of biology, biomimicry, and bio-inspired systems and their importance in engineering.
CO2	Analyze biological structures and mechanisms and identify their potential engineering applications.
CO3	Explain the principles of bio-inspired flight , including bird flight, wing design, bird-inspired UAVs, and morphing aircraft.
CO4	Describe and evaluate bio-inspired structures, materials, and robots , such as honeycomb structures and bio-inspired robotic systems.
CO5	Apply biological principles to aeronautical engineering problems to develop innovative, lightweight, efficient, and sustainable solutions.

Mapping of CO's, PO's with PSO's														
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	0	0	0	1	2	0	0	0	0	2	0	2
CO2	3	2	3	1	1	1	3	0	0	0	0	3	1	3
CO3	2	2	1	3	3	0	1	0	1	1	0	2	3	1
CO4	2	3	2	3	2	1	2	0	1	1	0	3	2	2
CO5	2	3	3	2	1	3	3	3	2	2	1	3	2	3

Mapping of CO's with Knowledge and Attitude Profile (WK)										
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0										
CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	
CO1	3	0	2	1	0	0	1	0	1	
CO2	2	0	2	3	2	1	1	1	2	
CO3	2	1	2	2	1	3	0	1	1	
CO4	2	1	2	3	2	2	1	1	2	
CO5	1	0	1	2	2	2	3	3	3	

Mapping of CO's with Sustainable Development Goals (SDG)																	
Strength of correlation: Strongly related-3, Moderately related-2, Weakly related-1, Not related-0																	
CO/SDG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0
CO2	0	0	1	0	0	3	0	0	2	0	2	0	1	0	1	0	0

Dr. Ambedkar Institute of Technology, Bengaluru - 560056
School of Core Engineering & Technology
Program: Aeronautical Engineering

Semester: IV

Scheme: 2025

CO3	0	0	2	0	0	2	0	0	0	0	1	0	0	0	1	0	0
CO4	0	0	0	0	0	3	0	0	2	0	0	1	1	0	0	0	0
CO5	0	0	2	0	0	2	0	0	2	0	3	2	2	0	1	0	1

Course Coordinator

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Heads of School:

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