KUMARAGURU COLLEGE OF TECHNOLOGY,

An Autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049

B.E AERONAUTICAL ENGINEERING

REGULATION 2024

CURRICULUM & SYLLABUS

I to VIII Semesters

Department of Aeronautical Engineering

DEPARTMENT VISION

To attain excellence and global reputation in Aeronautical Engineering Education and Research.

DEPARTMENT MISSION

- Provide quality education in Aeronautical Engineering to students to build their career and do quality research and thus contribute to the field of Aviation and Aerospace.
- Prepare students for higher studies in core and inter-disciplinary research to contribute to the advanced technological needs of Aeronautical engineering.
- Encourage faculty to update their knowledge and teaching-learning process through continuous learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of Aeronautical Engineering Undergraduate Program are:

PEO1: To provide in-depth knowledge in aeronautical engineering related fields to students and encourage them to practice in the chosen profession with professional ethics.

PEO2: To enable the graduates to pursue postgraduate degrees and conduct research at leading technological universities to contribute to the advancement in the field of Aviation and Aerospace industries.

PEO3: To continue their professional development by utilizing educational and career building opportunities through their employer, educational institutions, or professional bodies.

PROGRAM OUTCOMES (POs)

Graduates of the Aeronautical Engineering Undergraduate Program should have the ability to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the Aeronautical Engineering Undergraduate Program will have the ability to:

PSO1: Apply concepts and principles of Aerodynamics, Aircraft Structures, Aircraft Propulsion, Aerospace Materials, UAV and Avionics, Artificial Intelligence to provide solutions to critical industrial problems, while adhering to industrial standards.

PSO2: Use the software packages in the design, manufacturing, testing and maintenance of aeronautical and aerospace-based components and systems.

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Semester I

S. No.	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HST101	Heritage of Tamils	Theory	HS	1	0	0	0	1
2	24MAI111	Linear Algebra and Calculus	Embedded	BS	3	0	2	0	4
3	24PHI106	Engineering Physics	Embedded	BS	3	0	2	0	4
4	24MEI101	Engineering Graphics	Embedded	ES	2	0	2	0	3
5	24EET105	Basics of Electrical and Electronics Engineering	Theory	ES	3	0	0	0	3
6	24ADP001	Basics of Artificial Intelligence	Practical	ES	0	0	2	0	1
7	24INP102	Innovation Practicum – 1	Practical	ES	0	0	2	0	1
8	24HSP111	Holistic Wellness – 1	Practical	HS	0	0	2	0	1
9	24INP101	Design Thinking	Practical	ES	0	0	2	0	1
10	24INO1- -	FCLF – General Stack – 1	Practical	OE	0	0	2	0	1
								Total Credits	**20**
								Total Contact Hours/week	**28**

Semester II

S. No.	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HST102	Tamils and Technology	Theory	HS	1	0	0	0	1
2	24HST103 / 24HST104	Effective Communication / Professional Communication	Theory	HS	2	0	0	0	2
3	24MAI121	Advanced Calculus and Laplace Transforms	Embedded	BS	3	0	2	0	4
4	24CYI104	Material Chemistry	Embedded	BS	3	0	2	0	4
5	24MET104	Engineering Mechanics	Theory	ES	3	0	0	0	3
6	24PHT107	Materials Science for Aeronautical Engineering	Theory	ES	3	0	0	0	3
7	24CSI101	Logical thinking and Problem Solving	Embedded	ES	3	0	2	0	4
8	24INP103	Innovation Practicum – 2	Practical	ES	0	0	2	0	1
9	24HSP112	Holistic Wellness – 2	Practical	HS	0	0	2	0	1
10	24INO1- -	FCLF – General Stack – 2	Practical	OE	0	0	2	0	1
								Total Credits	**24**
								Total Contact Hours/week	**30**

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Semester III

S. No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HSP005	Mastering Conversations	Practical	HS	0	0	2	0	1
2	24MAT231	Partial Differential Equations and Transforms Techniques	Theory	BS	3	1	0	0	4
3	24AEI201	Aero Engineering Thermodynamics	Embedded	PC	2	0	2	0	3
4	24AEI202	Engineering Fluid Mechanics and Hydraulics	Embedded	PC	2	0	2	0	3
5	24AET203	Solid Mechanics	Theory	PC	3	0	0	0	3
6	24AET204	Principles of Flight	Theory	PC	3	0	0	0	3
7	24INM201	UHV-II: Understanding Harmony	Theory	HS	1	0	0	0	1
8	24AEP205	CAD Laboratory	Practical	PC	0	0	2	0	1
9	24INP201	Innovation Practicum – 3	Practical	ES	0	0	2	0	1
10	24INO---	FCLF – General Stack – 3	Practical	OE	0	0	2	0	1
11	-	Internship/Mini Project-1	Project	PRJ	0	0	0	2	1
								Total Credits	**22**
								Total Contact Hours/week	**29**

Semester IV

S. No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HSP006	Mastering Group Discussion and Presentation Skills	Practical	HS	0	0	2	0	1
2	24MAI241	Numerical Methods and Probability	Embedded	BS	3	0	2	0	4
3	24AEI206	Aerodynamics I	Embedded	PC	2	0	2	0	3
4	24AEI207	Aircraft Structures I	Embedded	PC	2	0	2	0	3
5	24AEI208	Aircraft Propulsion	Embedded	PC	2	0	2	0	3
6	24AET209	Aircraft Mechanisms and Machine Dynamics	Theory	PC	3	0	0	0	3
7	24AET210	Aircraft Systems and Instruments	Theory	PC	3	0	0	0	3
8	24INM102	Indian knowledge Systems in Science and Engineering	Theory	HS	1	0	0	0	1
9	24INP202	Innovation Practicum – 4	Practical	ES	0	0	2	0	1
10	24INO---	FCLF – Technical Stack – 1	Practical	OE	0	0	2	0	1
11	24INO---	FCLF – Emerging Stack – 1	Practical	OE	0	0	2	0	1
								Total Credits	**24**
								Total Contact Hours/week	**32**

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Semester V

S. No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24HSP007	Building Professional Readiness	Practical	HS	0	0	2	0	1
2	24AET301	Aerodynamics II	Theory	PC	3	0	0	0	3
3	24AEI302	Aircraft Structures II	Embedded	PC	2	0	2	0	3
4	24AEI303	Computational Fluid Dynamics	Embedded	PC	2	0	2	0	3
5	24AET304	Rocket and Spacecraft Propulsion	Theory	PC	3	0	0	0	3
6	24INM202	Environmental Science & Sustainability	Embedded	HS	1	0	2	0	2
7	24AEExxx	Professional Elective 1	Theory	PE	3	0	0	0	3
8	-	FCLF – Technical Stack – 2	Practical	OE	0	0	2	0	1
9	-	FCLF – Emerging Stack – 2	Practical	OE	0	0	2	0	1
10	-	Internship/Mini Project-2	Project	PRJ	0	0	0	4	2
								Total Credits	**22**
								Total Contact Hours/week	**30**

Semester VI

S. No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24AET305	Aviation Logistics and Supply Chain Management	Theory	PC	3	0	0	0	3
2	24AET306	Flight Dynamics	Theory	PC	3	0	0	0	3
3	24AEI307	Finite Element Analysis	Embedded	PC	2	0	2	0	3
4	24AET308	Aerospace Control Systems	Theory	PC	3	0	0	0	3
5	24AEExxx	Professional Elective 2	Theory	PE	3	0	0	0	3
6	24AEExxx	Professional Elective 3	Theory	PE	3	0	0	0	3
7	24INM002	Disaster Management and Preparedness	Theory	MC	2	0	0	0	0
8	24INM302	Constitution of India	Theory	HS	1	0	0	0	0
9	-	FCLF – Technical Stack – 3	Practical	OE	0	0	2	0	1
10	-	FCLF – Emerging Stack – 3	Practical	OE	0	0	2	0	1
11	24AEP309	Aircraft Systems and Maintenance Laboratory	Practical	PC	0	0	2	0	1
12	24AEP310	Aero Modeling and Flight Simulation Laboratory	Practical	PC	0	0	2	0	1
								Total Credits	**22**
								Total Contact Hours/week	**30**

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Semester VII

S. No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24AEI401	Aircraft Design	Embedded	PC	3	0	2	0	4
2	24AET402	Composite Materials and Structures	Theory	PC	3	0	0	0	3
3	24AEExxx	Professional Elective 4	Theory	PE	3	0	0	0	3
4	24AEExxx	Professional Elective 5	Theory	PE	3	0	0	0	3
5	24AEExxx	Professional Elective 6	Theory	PE	3	0	0	0	3
6	24AEJ401	Project - Phase 1	Project	PRJ	0	0	0	6	3
								Total Credits	**19**
								Total Contact Hours/week	**23**

Semester VIII

S. No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24AEJ402	Project - Phase 2	Project	PRJ	0	0	0	24	12
								Total Credits	**12**
								Total Contact Hours/week	**24**

Total Credits: 165

List of Mandatory Courses:

S.No	Couse Code	Course Title	Course Mode	CT	Sem
1	24INM201	UHV-II: Understanding Harmony	Theory	HS	III
2	24INM102	Indian Knowledge Systems in Science and Engineering	Theory	HS	IV
3	24INM202	Environmental Science and Sustainability	Embedded	HS	V
4	24INM002	Disaster Management and Preparedness	Theory	MC	VI
5	24INM302	Constitution of India	Theory	HS	VI

Professional Electives									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
TRACK-I (Aerodynamics)									
1	24AEC001	Experimental Aerodynamics	Embedded	PE	2	0	1	0	3
2	24AEE002	Hypersonic Aerodynamics	Theory	PE	3	0	0	0	3
3	24AEE003	Helicopter Aerodynamics	Theory	PE	3	0	0	0	3
4	24AEE004	Industrial Aerodynamics	Theory	PE	3	0	0	0	3
5	24AEC005	Computational Methods for Aerospace Analysis	Embedded	PE	2	0	2	0	3
6	24AEE006	Rockets and Missiles	Theory	PE	3	0	0	0	3
TRACK-II (Propulsion)									
1	24AEE007	Heat and Mass Transfer	Theory	PE	2	1	0	0	3
2	24AEE008	Cryogenic Engineering	Theory	PE	3	0	0	0	3
3	24AEE009	Combustion Techniques	Theory	PE	3	0	0	0	3
4	24AEE010	Advanced Propulsion Systems	Theory	PE	3	0	0	0	3
5	24AEE011	Turbomachines	Theory	PE	3	0	0	0	3
6	24AEC012	Computational Heat Transfer	Embedded	PE	2	0	1	0	3
TRACK-III (Structures)									
1	24AEE013	Fatigue and Fracture Mechanics	Theory	PE	3	0	0	0	3
2	24AEE014	Experimental Stress Analysis	Theory	PE	3	0	0	0	3
3	24AEE015	Vibrations & Aeroelasticity	Theory	PE	3	0	0	0	3
4	24AEE016	Smart Materials for Aerospace	Theory	PE	3	0	0	0	3
5	24AEE017	Theory of Elasticity	Theory	PE	3	0	0	0	3
6	24AEC018	Aero-Structural Optimization	Embedded	PE	2	0	1	0	3
TRACK-IV (Autonomous Aerial Systems & Avionics)									
1	24AEE019	Avionics & Aerospace Electronics	Theory	PE	3	0	0	0	3
2	24AEC020	Drone Fabrication and Testing	Embedded	PE	2	0	1	0	3
3	24AEC021	UAV Design & Simulation	Embedded	PE	2	0	1	0	3
4	24AEE022	Autonomous Navigation & SLAM	Theory	PE	3	0	0	0	3
5	24AEE023	AI for Autonomous Flight	Theory	PE	3	0	0	0	3
6	24AEE024	Estimation and Sensor Fusion Techniques	Theory	PE	3	0	0	0	3
TRACK-V (Aerospace Digital Engineering & Advanced Manufacturing)									
1	24AEE025	Digital Twins for Aerospace	Theory	PE	3	0	0	0	3
2	24AEE026	Additive Manufacturing	Theory	PE	3	0	0	0	3
3	24AEE027	AI & ML in Aviation	Theory	PE	3	0	0	0	3
4	24AEE028	Manufacturing Technology for Aerospace	Theory	PE	3	0	0	0	3
5	24AEE029	Product Design and Development	Theory	PE	3	0	0	0	3
6	24AEE030	Product Lifecycle Management	Theory	PE	3	0	0	0	3
TRACK-VI (Aerospace Operations, Airworthiness & Sustainment)									
1	24AEE031	Aerospace Certification and Standards	Theory	PE	3	0	0	0	3

2	24AEE032	Aerospace NDT Methods and Practices	Theory	PE	3	0	0	0	3
3	24AEE033	Aerospace Technical Documentation	Theory	PE	3	0	0	0	3
4	24AEE034	Aircraft Maintenance Repair and Overhaul	Theory	PE	3	0	0	0	3
5	24AEE035	Airport Planning & Air Traffic Control	Theory	PE	3	0	0	0	3
6	24AEE036	Space Technology & Satellite Systems	Theory	PE	3	0	0	0	3

Honors in Space Technology									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1	24AEE037	Introduction to Space Technology	Theory	PC	3	0	0	0	3
2	24AEE038	Launch Vehicle Systems and Technologies	Theory	PC	3	0	0	0	3
3	24AEE039	Spaceflight Mechanics and Attitude Dynamics	Theory	PC	3	0	0	0	3
4	24AEE040	Spacecraft Systems Engineering	Theory	PC	3	0	0	0	3
5	24AEE041	Space Data Products and Services	Theory	PC	3	0	0	0	3
6	24AEJ042	Project	Project	PRJ	0	0	0	6	3

Semester-1

24HST101	தமிழர் மரபு / HERITAGE OF TAMILS (Common to all Departments)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	4, 11, 16			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அம்சங்களை அறிமுகப்படுத்துதல், அதன் தொன்மைக்காலம் முதல் நவீனகாலம் வரையிலான வளர்ச்சியை விளக்கம் செய்யுதல். Introduce students to the foundational aspects of Tamil language and literature, tracing its evolution from ancient to modern times.
2	தமிழகத்தின் செழுமையான கலாச்சார பாரம்பரியத்தை அறிமுகப்படுத்துதல், பாறை ஓவியக் கலையிலிருந்து நவீன சிற்ப கலையின்படி அதன் கலை வெளிப்பாடுகளை ஆராய்தல். Familiarize students with the rich cultural heritage of Tamil Nadu, exploring its artistic expressions from rock art paintings to contemporary sculptures.
3	தமிழகத்தின் நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகளை அறிதல்- தினணக்கோட்பாடுகளை ஆராய்தல்- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல். To know the folk arts and heroic ames of Tamilnadu-explore the concept of thinai -to know the role of Tamils in Indian National movement.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	தமிழ் மொழி மற்றும் இலக்கியத்தின் அடிப்படை அறிவை மேம்படுத்துதல். மொழி பண்பாட்டில் எவ்வாறு இணைந்துள்ளது என்பதை உணர்தல். Enhance the fundamental knowledge of Tamil language and literature	U
CO2	பழங்கால பாறை ஓவியங்கள், சிற்பம் என கலைகள் நவீன காலம்வரை எவ்வாறு பயணிக்கிறது என்பதை புரிந்துகொள்ளுதல். Understand the heritage, rock art paintings to modern art sculpture	U
CO3	நாட்டுப்புறக் கலைகள் தற்காப்புக் கலைகளாகவும், உடல் ஆரோக்கியத்தை மேம்படுத்தும் விதமாகவும் அமைவதை அறிந்து கலைகள் மீதான ஆர்வத்தை அதிகரிக்கச் செய்தல்- தமிழர்களின் அகத்திணை, புறத்திணை கோட்பாட்டினை புரிந்து கொள்ளுதல். இந்திய பண்பாட்டில் தமிழர்களின் பங்களிப்பை அறிதல். Acquire essential knowledge in the folk and martial arts-understanding the Agam and puram concept- to know the contribution of Tamils in Indian culture.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1							3	2	2		2		
2							3	3	2		2		
3							3	2	2		2		

Course Content

மொழி மற்றும் இலக்கியம் இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தொடக்கம் -பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. **LANGUAGE AND LITERATURE** Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	**3 Hours**
மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புற தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு. **HERITAGE – ROCK ART PAINTINGS TO MODERN ART SCULPTURES** Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	**3 Hours**

நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள். **FOLK AND MARTIAL ARTS** Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Ciabatta, Valari, Tiger dance - Sports and Games of Tami	**3 Hours**
தமிழர்களின் திணைக்கோட்பாடுகள் தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பொடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் தமிழர்களின் வெற்றி. **THINAI CONCEPTS OF TAMIL** Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	**3 Hours**
இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு. **CONTRIBUTIONS OF TAMIL TO INDIAN NATIONAL MOMENT AND INDIAN CULTURE** Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	**3 Hours**

Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 15

Learning Resources

Reference books:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

Online Educational Resources:

1. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e
2. https://www.youtube.com/watch?v=j6_ddjn_gLc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=2
3. https://docs.google.com/presentation/d/1pf0jbyuDTNdvlcKMnOfoPjbqha7JqdOc/edit#slide=id.p1
4. https://www.youtube.com/watch?v=IKPwEmsmuZc&list=PLMMrJE4pHZmc0iJZIE6lBpFoPK_9Y325e&index=1

Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE), Assignments, Quiz, Library Record

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institutions	Internal Expert
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Suriya Prakash Department of Language

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MAI111	LINEAR ALGEBRA AND CALCULUS (Common to AE, AU, CE, ME, MR)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Understand the matrix theory for diagonalization, transformations, and their applications in engineering.
2	Solve optimization problems using differential calculus.
3	Apply partial differentiation for constrained optimization and numerical evaluation.
4	Use integral calculus, including double and triple integrals, to solve engineering problems.
5	Implement mathematical concepts using MATLAB to solve practical engineering problems.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply eigenvalues for matrix diagonalization and transformations and analyse results using computational tools.	Ap
CO2	Apply differentiation for solving optimization problems and enhance solutions through computational tools.	Ap
CO3	Analyse and solve unconstrained and constrained optimization problems using the Lagrange multiplier method and determine the maxima and minima of functions with two or more variables relevant to engineering application	An
CO4	Apply integral calculus and computational tools to solve engineering problems.	Ap
CO5	Apply double integrals and computational tools for solving engineering problems.	Ap
CO6	Apply triple integrals techniques and computational tools to solve complex problems.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2	2		1	1								
2	1	2		1	1								
3	1	1		1	1								

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
4	1	1		1	1								
5	1	1		1	1								
6	1	1		1	1								

Course Content:

MATRICES Eigenvalues and Eigenvectors of a real matrix - Properties of eigenvalues and eigenvectors - Orthogonal matrices - Orthogonal transformation of a symmetric matrix to diagonal form - Reduction of quadratic form to canonical form by orthogonal transformation. **Practical Component** • Use MATLAB to compute Matrix Operations - Addition, Multiplication, Transpose, Inverse and Rank of a matrix. • Determining Eigenvalues and Eigenvectors of Matrices.	**9 Hours** **6 Hours**
DIFFERENTIAL CALCULUS Representation of Functions – Limit and Continuity – Differentiation – Rolles Theorem and Mean Value Theorem-Maxima and Minima **Practical Component** • Evaluating Limits and Derivatives • Determining Maxima and Minima of a function of one variable.	**9 Hours** **6 Hours**
PARTIAL DIFFERENTIALS Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians. **Practical Component** • Function Approximations with Taylor Series • Determining Maxima and Minima of a function of two variables.	**9 Hours** **6 Hours**
INTEGRAL CALCULUS Definite and Indefinite integrals - Techniques of Integration: Substitution rule, Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction. **Practical Component** • Integration of Rational Functions • Integration of Trigonometric Functions	**9 Hours** **6 Hours**
MULTIPLE INTEGRALS Double integration in Cartesian coordinates – Change of order of integration - Triple integration in Cartesian coordinates – Area as double integral and Volume as triple integral. **Practical Component** • Evaluating double integral with constant and variable limits. • Evaluating triple integral with constant and variable limits.	**9 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2023.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited., New Delhi, 2018.
3. Kreyzig E., "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, 2023.

Reference books

1. Veerarajan T., "Engineering Mathematics (for First Year)", Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2008.
2. Joel R. Hass, Christopher E. Heil, Maurice D. Weir, Przemyslaw Bogacki, George B. Thomas, "Thomas' Calculus", Pearson education 15th Edition, 2024.
3. G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 11th Edition, Pearson Education, 2010.
4. James Stewart, Daniel Clegg, Saleem Watson, "Calculus: Early Transcendentals", Cengage Learning, New Delhi, 9th Edition, 2020.
5. William J. Palm III, "MATLAB for Engineers: Global Edition", McGraw-Hill Education, 5th Edition, 2018.

Online Resources (Web Links)

1. Linear Algebra | Mathematics | MIT Open Courseware https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/
2. Matrix Algebra for Engineers | Coursera https://www.coursera.org/learn/matrix-algebra-engineers
3. Differential Calculus | Khan Academy https://www.khanacademy.org/math/calculus-1
4. Multivariable Calculus | Mathematics | MIT Open Courseware https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
5. Integral Calculus | Khan Academy https://www.khanacademy.org/math/calculus-2
6. Multivariable Calculus | Khan Academy https://www.khanacademy.org/math/multivariable-calculus
7. Brilliant | Learn Interactively https://www.brilliant.org/

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. Mr.Jayakumar Venkatesan,	Dr.T.Govindan, Government College of Engineering, Srirangam, Trichy. Dr.C.Porkodi,	1. Dr. N.Anitha, 2. Ms. S. Sivasakthi, 3. Dr. S.Selvanayaki, Department of Mathematics

Valles Marineras International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore	PSG College of Technology, Coimbatore. Dr.P.Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.		
Recommended by BoS on	16.8.2024		
Academic Council Approval	No: 27	**Date**	24.8.2024

24PHI106	ENGINEERING PHYSICS (Common for AE, AU, ME)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Provide students with a strong understanding of the principles of elasticity, quantum mechanics, and laser technology.
2	Enable students to analyze and apply techniques related to non-destructive testing and surface coatings for various engineering applications.
3	Introduce and assess green energy technologies, guiding students in recommending sustainable solutions for energy use.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the principles of elasticity to solve problems related to stress, strain, and bending of beams.	U
CO 2	Analyse the fundamentals of quantum mechanics to interpret the behaviors of particles at the atomic and subatomic levels	Ap
CO 3	Evaluate the principles of laser operation to assess their applications in various fields such as imaging and holography.	Ap
CO 4	Examine the methods of non-destructive testing to categorize and select appropriate surface coating techniques.	Ap
CO 5	Assess various green energy technologies to recommend efficient solutions for sustainable energy use.	U
CO 6	Apply scientific methods and experiment techniques to enhance understanding of fundamental concepts and their application in various technological fields.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2			1						2		
2	3	2			1								
3	3	2			1								

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
4	3	2		2	1						2		
5	3	2			1						2		
6	3	2			1								

Course Content

PROPERTIES OF MATTER Hooke's Law - Elastic moduli - Relation between elastic constants - Poisson's Ratio – Stress - Strain Diagram and its uses – factors affecting elastic modulus – Bending of beams – Expression for bending moment and depression - Cantilever - Depression of a cantilever - experimental determination of Young's modulus by Non uniform bending – I shape girders. **Practical Component** 1. Non-uniform bending – Determination of Young's modulus 2. Compound pendulum – Determination of acceleration due to gravity	**9 Hours** **6 Hours**
QUANTUM PHYSICS Necessity of quantum mechanical picture- Planck's concept (hypothesis) - Wave particle duality - de-Broglie waves - Physical significance of wave function - Schrodinger equation- Time independent and time dependent equation - Particle in a box- Eigen values and Eigen function- Superposition Principle- Quantum mechanical tunnelling through a barrier. **Practical Component** 1. Determination of Planck's constant – Electroluminescence method.	**9 Hours** **6 Hours**
LASERS Interaction of light and matter - Quantization of electromagnetic radiation – Absorption, Spontaneous emission and Stimulated emission - Einstein's theory of stimulated emission- Population inversion - Sources of excitation - Active medium -Laser beam output- Nd-YAG laser - CO2 laser - Applications – Laser Imaging and Holography- Laser gyroscopes. **Practical Component** 1. Semiconductor laser: a. Determination of wavelength of laser b. Determination acceptance angle and numerical aperture of an optical fiber. c. Determination of particle size 2. Spectrometer – Determination of wavelength of mercury source using grating	**9 Hours** **6 Hours**
NDT AND SURFACE COATINGS NDT: Liquid penetrant method – ultrasonic flaw detector: A scan, B scan and C scan – X- ray radiography and fluoroscopy – thermography Surface Coatings: Thin film deposition through - Electro deposition – Spin coating – Electrospinning- Physical Vapour Deposition (PVD)- Industrial Applications - Automotive Industry and aerospace Industry. **Practical Component** 1. Determination of thermal conductivity of a bad conductor – Lee's Disc method 2. Melde's string – Determination of frequency of a tuning fork 3. Determination of magnetic susceptibility of a solid material – B-H curve apparatus	**9 Hours** **6 Hours**
GREEN ENERGY Introduction to Green energy – Solar energy: Energy conversion by photovoltaic principle – Solar cells – Efficiency measurements – Types (First, Second and Third Generation) of Solar Cells - Wind energy: Basic components and principle of wind energy conversion systems –	**9 Hours**

Ocean energy: Wave energy – Wave energy conversion devices. Futuristic Energy: Hydrogen – Methane Hydrates – Carbon capture and storage (CCS). **Practical Component** 1. Determination of efficiency of solar cell 2. Determination of band gap of a semiconductor	**6 Hours**

Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	75

Learning Resources

Textbooks:

1. M N Avadhanulu, P.G. Kshirsagar, and TVS Arun Murthy. A Textbook of Engineering Physics, 11th Edition. S. Chand Publications (2018).
2. R.K. Gaur and S.L. Gupta. Engineering Physics, 10th Edition. Dhanpat Rai Publications (P) Ltd., New Delhi (2016).
3. Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury. Concepts of Modern Physics, 7th Edition. McGraw Hill Education, New Delhi (2017).
4. V. Rajendran. Applied Physics. Tata McGraw Hill Publishing, New Delhi (2017).

References:

1. Brij Lal and Subrahmanyam. Properties of Matter. S. Chand & Co Ltd., New Delhi (2014).
2. Satya Prakash. Quantum Mechanics. Pragati Prakashan Publishers (2015).
3. K. Thiagarajan and Ajoy Ghatak. Lasers: Fundamentals and Applications. Springer Science & Business Media (2010).
4. Marcel Dekker. Ultrasonics: Fundamentals, Technology, Applications, Second Edition. New York (1988).
5. William Silfvast Hill. Laser Fundamentals. Cambridge University Press (2018).
6. S.O. Pillai. Solid State Physics, Ninth Edition. New Age International Press (2020). Godfrey Boyle. Renewable Energy: Power Sustainable Future, Second Edition. Oxford University Press, UK (2019).
7. Chetan Singh Solanki. Solar Photovoltaics – Fundamentals, Technologies and Applications. PHI Learning Private Limited (2019).

Online Resources (Weblinks)

1. https://www.khanacademy.org/science/physics/forces-newtons-laws/hookes law-and-elasticity
2. https://ocw.mit.edu/courses/1-050-solid-mechanics-fall-2004/
3. https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/
4. https://spie.org/PA/conferencedetails/holography-and-diffractive-optics#_=_
5. https://archive.nptel.ac.in/courses/113/106/113106070/
6. https://onlinecourses.nptel.ac.in/noc24_ge56/preview
7. https://ocw.mit.edu/courses/ec-s07-photovoltaic-solar-energy-systems-fall 2004/

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr R Sengodan & Dr M Selvambikai Department of Physics	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MEI101	ENGINEERING GRAPHICS (Common to AE, AU, CE, FT, ME, MR, TT)	L	T	P	J	C
		2	0	2	0	3
ES		SDG		4, 9, 11		

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the importance of graphics in the design process, including visualization, communication, and documentation.
2	Develop proficiency in constructing various curves, orthographic projections, and using drafting tools.
3	Gain the ability to project and section simple solids and develop lateral surfaces and isometric projections.
4	Learn to use AutoCAD for sketching, editing objects, and creating detailed engineering drawings.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the construction of curves such as ellipses, parabolas, and hyperbolas to accurately visualize and communicate design ideas using drafting tools.	Ap
CO 2	Analyze the projections of points, lines, and planes to determine true lengths and inclinations for effective representation of objects in design.	An
CO 3	Evaluate the projections and sections of solids like prisms, pyramids, cylinders, and cones to create accurate sectional views and true shapes in engineering drawings.	An
CO 4	Create developments of surfaces for simple solids and construct isometric projections to enhance the design process with three-dimensional visualizations.	An
CO 5	Design free-hand sketches of orthographic views using AutoCAD.	Ap
CO 6	Apply AutoCAD commands to demonstrate object selection and editing techniques, enabling precise modifications in engineering drawings.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2	2			2								
2		2		2						2			
3		2	2				2						
4	2		2		2								
5	2				2					2			
6	2				2					2			

Course Content	
PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANES • Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points. • Construction of cycloid — Construction of spirals - Construction of involutes of square and circle. • Drawing of tangents and normal to the above curves. • Projections of straight lines located in first quadrant - determination of true length and true inclinations. • Projections of plane surfaces - polygonal lamina and circular lamina, located in the first quadrant and inclined to one reference plane.	**6 Hours** **6 Hours**
PROJECTION AND SECTION OF SOLIDS • Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane. • Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.	**6 Hours** **6 Hours**
DEVELOPMENT OF SURFACES, ISOMETRIC PROJECTIONS • Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones. • Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.	**6 Hours** **6 Hours**
FREE-HAND SKETCHING AND INTRODUCTION TO AUTOCAD • Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning. Free hand sketching of isometric views from orthographic views. • Introduction to Drafting Software (AutoCAD) & its Basic Commands. Introduction to coordinate systems, object selection methods, selection of units and precession. Annotation and dimensions, Object properties.	**6 Hours** **6 Hours**
DRAWING ORGANIZATION AND HOUSE PROJECT AutoCAD - Sketching – line, circle, arc, polygon, rectangle and ellipse. Working with object snaps, layers and object properties. Editing the objects – copy, move, trim, extend, working with arrays, mirror, scale, hatch, fillet and chamfer. Isometric views of simple solid blocks.	**6 Hours** **6 Hours**

Theory Hours:	30	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	60

Learning Resources

Textbooks:

1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.
2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.

References:

1. Nataraajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
2. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
3. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.
4. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Online Resources (Open sources):
1. https://www.khanacademy.org/math/differential-calculus 2. https://nptel.ac.in/courses/106105171 3. https://swayam.gov.in/nd1_noc19_cs42/preview

Assessment (Embedded course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by		
Expert from Industry	**Expert from Higher Education Institutions**	**Internal Expert**
Mr. G. Vergin Vino Design Engineer TANCAM, Chennai	Dr. V. Prabhuraja Professor Department of Mechanical Engineering PSG College of Technology, Coimbatore	Dr. K. M Senthil Kumar Associate Professor Department of Mechanical Engineering

Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24EET105	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	J	C
		3	0	0	0	3
ES		SDG	7, 9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental laws and concepts to analyse simple DC and AC circuits
2	Illustrate the components of electrical installations, including LT switchgear, wiring, earthing, and batteries.
3	Understand the construction, working principles, and applications of electrical machines and their application in aircraft systems
4	Familiarize the students with the construction, operation, and applications of semiconductor devices
5	Understand and design the fundamental digital logic concepts, including logic gates, adder and flip-flops.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse the fundamentals principles of DC and AC circuits	An
CO 2	Apply various protective devices and Energy storage systems for various applications with a focus on energy efficiency and safety	Ap
CO 3	Analyse the construction and working of DC motor, transformer, and induction motors and choose the motor for aircraft applications.	Ap
CO 4	Illustrate the working of semiconductor devices and understand their applications in aircraft systems.	Ap
CO 5	Apply the fundamentals of Boolean logic to design digital logic circuits.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	1											
2	3					1							
3	2											1	
4		1										1	
5	2	2										1	

Course Content

DC AND AC CIRCUITS Basic circuit elements and sources, Ohms law, Kirchhoff's laws, Series and parallel connection of circuit elements, Power, Work, Energy, Capacitance, Energy stored in a capacitor, DC circuits in Aircraft systems. Alternating voltages and current, Sinusoidal waveform, Cycle and frequency, RMS value, Alternating current through Resistance, Inductance and Capacitance, Power factor, Active and Reactive power, AC circuits in Aircraft systems.	**9 Hours**
ELECTRICAL INSTALLATIONS Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Aircraft storage Batteries - Important Characteristics for Batteries - Elementary calculations for energy consumption, power factor improvement.	**9 Hours**
ELECTRICAL MACHINES (Qualitative Treatment Only) Construction and working Principle of DC Motors, PMDC motors, Single phase Transformers, Alternators and single-phase induction motors, PM Stepper motor, Applications of Electrical machines in Aircraft systems.	**9 Hours**
SEMICONDUCTOR CIRCUITS Construction and working Principle of PN junction diode, Zener Diode, Half wave and Full wave rectifiers, BJT, CE and CB Configurations, MOSFET, Operational amplifiers, A/D and D/A converters.	**9 Hours**
DIGITAL CIRCUITS Logic Gates - Boolean algebra - Half and Full Adders, subtractors - Multiplexer - Demultiplexer - Encoders - Decoders - Flip flops - Introduction to Microprocessors and Microcontrollers**.**	**9 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 45

Learning Resources

Textbooks

1. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj - Basic Electrical and Electronics Engineering, 3rd Edition, McGraw Hill Education, 2021
2. S.L. Uppal, G.C. Garg - Electrical Wiring, Estimating and Costing, 6th Edition, Khanna Publishers, 2022

Reference books

1. Mike Tooley and David Wyatt, 'Aircraft Electrical and Electronic Systems Principles, Operation and Maintenance', Elsevier, 2018
2. P.S. Bimbhra - Electrical Machinery, 8th Edition, Khanna Publishers, 2023
3. V.K. Mehta, Rohit Mehta - Principles of Electrical Engineering, 2nd Edition, S. Chand Publishing, 2022
4. B.L. Theraja, A.K. Theraja - A Textbook of Electrical Technology - Vol. 2: AC & DC Machines, 25th Edition, S. Chand Publishing, 2023
5. Adel S. Sedra, Kenneth C. Smith - Microelectronic Circuits, 8th Edition, Oxford University Press, 2023

Online Resources (Web Links)

1. https://www.coursera.org/learn/electronics
2. https://archive.nptel.ac.in/courses/108/105/108105053/

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert from Industry	**Expert from Higher Education Institution**	**Internal Expert(s)**	
Dr. T. Viswanathan Bosch Global Software Technologies, Coimbatore	Dr. Sundaram M Associate Professor/EEE PSG College of Technology, Coimbatore	Dr. N.Prakash Assistant Professor -III Department of EEE Dr.S.Senthil Kumar Assistant Professor -I Department of Aeronautical Engineering	
Recommended by BoS on	14.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24ADP001	BASICS OF ARTIFICIAL INTELLIGENCE (Common to all Departments except CS, IT, AD)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	8, 9, 16			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Introduce students to the fundamentals of Artificial Intelligence (AI) and Generative AI, and its key concepts
2	Enable students to explore and experiment with common generative AI models and tools for generating text, images, audio, video, and code
3	Equip students with the techniques and best practices for crafting effective prompts for AI models

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the fundamentals of AI and generative AI, including its potential impact, issues, limitations, and ethical concerns and its practical use cases in real-world scenarios.	U
CO 2	Explore common generative AI models and tools for text, code, image, audio, and video generation.	E
CO 3	Apply common prompt engineering techniques and approaches for writing effective prompts.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1 Engineering Knowledge	2 Problem Analysis	3 Design/Development of Solutions	4 Conduct Investigations of Complex Problems	5 Engineering Tool Usage	6 The Engineer and The World	7 Ethics	8 Individual and Collaborative Team work	9 Communication	10 Project Management and Finance	11 Life-Long Learning	PSO-1	PSO-2
1	2						2						
2	2		2										
3					2					2			

Course Content

INTRODUCTION TO ARTIFICIAL INTELLIGENCE (AI) **PRACTICAL COMPONENT** Introduction to Artificial Intelligence (AI) - Generative AI Overview and Use Cases - Impact and Examples of AI - Application Domains for AI - Generative AI Applications. AI Concepts, Terminology - Cognitive Computing (Perception, Learning, Reasoning) - Terminology and Related Concepts of AI- Machine Learning Techniques and Training - Deep Learning - Neural Networks - Natural Language Processing, Speech, Computer	**8 Hours**

Vision - Self Driving Cars. AI: Issues, Concerns and Ethical Considerations - AI Ethics, Regulations, Governance, and ESG. The evolution and future of AI - The AI Ladder - The Journey for Adopting AI Successfully - Hotbeds of AI Innovation.	
GENERATIVE AI: INTRODUCTION AND APPLICATIONS **PRACTICAL COMPONENT** Introduction and Capabilities of Generative AI - Applications of Generative AI - Tools for Text Generation - Tools for Image Generation - Tools for Audio and Video Generation - Tools for Code Generation	**6 Hours**
GENERATIVE AI: PROMPT ENGINEERING BASICS **PRACTICAL COMPONENT** Introduction to Prompt and Prompt Engineering - Best Practices for Prompt Creation - Common Prompt Engineering Tools - Hands on Lab: Getting to Know Our AI Prompting - Experimenting with Prompts - Naive Prompting and Persona Pattern. Prompt Engineering Techniques and Approaches - Text-to-Text Prompt Techniques - Interview Pattern Approach - Chain-of-Thought Approach - Tree-of-Thought Approach - Future of Human-Crafted Prompts - Text-to-Image Prompt Techniques - Hands-on Lab: Effective Text Prompts for Image Generation.	**7 Hours**
PROJECT AND WRAP UP **PRACTICAL COMPONENT** Graded Quiz Final Project: Generating Text, Images, and Code.	**9 Hours**

Theory Hours: 0	**Tutorial Hours: 0**	**Practical Hours: 30**	**Project Hours: 0**	**Total Hours: 30**

Learning Resources

Textbooks:

1. George F. Luger "Artificial Intelligence: Structures and Strategies for Complex Problem Solving" (6th Edition), Pearson, 2021.
2. Anna Jordan, Robert S. Menzies, Kristine P. Schwab, "AI-Powered Creativity: Generative AI and the Future of Content Creation" Routledge, 2023.

References:

1. https://platform.openai.com/docs/overview
2. https://towardsdatascience.com/
3. https://gemini.google.com/

Online Resource (Weblinks)

1. Introduction to Artificial Intelligence (AI) | Coursera
2. Generative AI: Introduction and Applications | Coursera
3. Generative AI: Prompt Engineering Basics | Coursera

Assessment (Practical course)

MCQ, Mini project and viva-voce

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
-	-	Dr. S. Sangeetha, Associate Professor Department of AI&DS

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24INP102	INNOVATION PRACTICUM – 1 (Common to all Departments)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Analyse the effectiveness of systems thinking and problem-solving methodologies in applying data-driven insights for innovative solution design.
2	Evaluate the impact of transdisciplinary collaboration on creating functional hardware prototypes through fabrication techniques.
3	Understand the future trends and implications of technology in developing innovative products.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Recall the fundamental principles of custom hardware design.	R
CO2	Understand the appropriate tools and their applications for solving hardware-related problems.	U
CO3	Apply systems engineering concepts to real-world hardware design challenges.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2		1										
2	2				1								
3		2	2	1									

Course Content

ENGINEERING FUNDAMENTALS AND INNOVATION — **3 Hours**

Why engineering? The concept of street fight engineering - Real-world design process and problem-solving methodology - Data-driven insights and concept generation - Case studies of successful engineering innovations.

TRANSDISCIPLINARY SYSTEMS AND MANU'FUTURING Transdisciplinary systems to accelerate innovation - Manu'Futuring: Technology in hardware manufacturing and manufacturing of hardware technologies - Future scopes with product case studies.	**6 Hours**
BUILDING CUSTOM HARDWARE How to build a basic custom hardware - Electronics fundamentals and components - Software for hardware control - Fabrication techniques.	**6 Hours**
SYSTEM THINKING AND ENGINEERING Introduction to system thinking - Real world as a system - Concept of system engineering and its application – iLenSys.	**7 Hours**
CREATIVITY TIME AND TECH TEARDOWN Creativity exercise: Apply system thinking to a real-world problem - Tech teardown: Analyse a product or system to understand its engineering principles - Presentation: Present your creative project and tech teardown with an engaging title	**8 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:
0	0	30	0	30

Learning Resources

Textbooks:

1. Sanjoy Mahajan - Street Fighting Mathematics
2. Donald Knuth - The Art of Computer Programming
3. Think like a programmer: An introduction to creative problem solving
4. Thinking in Systems: A Primer

References:

1. Learning to code: How to think like a programmer
2. How to find innovative ideas: Ramesh Raskar's note
3. Case study: How Tesla changed the auto industry
4. Ultimate Guide: How to develop a new electronic hardware product

Online Resources (Weblinks)

1. https://www.ifixit.com/Teardown?srsltid=AfmBOorwzDG9RhJoL3L5tlZ_Dr4sVcey-vPC-pkKTj2E0mWJWtFYlikY
2. https://www.symmetryelectronics.com/technology-teardowns/

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert from Industry	Expert from Higher Education Institutions	Internal Expert
Dr. Mahesh Veezhinathan Director - Innovation Practicum Associate VP - Forge. Innovation	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering

Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP111	HOLISTIC WELLNESS-1 (Common to all Departments)	L	T	P	J	C
		0	0	2	0	1
HS		SDG	2, 3			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Introduce first-year students to the foundational concepts of holistic wellness, emphasizing the integration of physical, mental, emotional, and Internal well-being.
2	Create a balanced lifestyle that promotes overall health and happiness through practical activities.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the basic principles of holistic wellness.	U
CO 2	Apply strategies for maintaining physical health, including nutrition and exercise	Ap
CO 3	Practice mindfulness techniques to enhance mental and emotional well-being.	Ap
CO 4	Develop a personal wellness plan incorporating various aspects of holistic health.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1						2		1					
2						2							
3						1					3		
4						2					3		

Course Content

INTRODUCTION TO HOLISTIC WELLNESS: • Overview of holistic wellness: physical, mental, emotional, and internal health. • The importance of balance in overall well-being. • Hands-on activity: Self-assessment of current wellness status.	**4 Hour**
PHYSICAL WELLNESS: • Importance of physical activity and exercise.	**14 Hours**

• Understanding nutrition and its role in health. • Sleep hygiene and its impact on well-being. • Hands-on activity: Designing a personalized fitness and nutrition plan.	
MENTAL AND EMOTIONAL WELLNESS: • Stress management techniques. • The role of Yoga, mindfulness and meditation in mental health. • Emotional intelligence and its impact on relationships. • Hands-on activity: Practicing Yoga, mindfulness and emotional regulation exercises.	**6 Hours**
INTERNAL WELLNESS: • Exploring the concept of Internal wellness. • The role of purpose and meaning in life. • Introduction to meditation and reflective practices. • Hands-on activity: Developing a personal reflection, Yoga and meditation routine.	**4 Hours**
INTEGRATING WELLNESS PRACTICES: • Combining physical, mental, emotional, and Internal wellness practices into daily life. • Developing a balanced wellness plan. • Hands-on activity: Creating a comprehensive personal wellness plan.	**2 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
2. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).

References:

1. B.K.S Iyengar., Yoga: The Path to Holistic Health., Dorling Kindersley Limited, City of Publication (2001)
2. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
3. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
4. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
5. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart ., WS Press, Newtown, PA (2023)

Online Resources (Weblinks)

1. Learning Suryanamskar
2. Yoga for well-being
3. Nutritional Educational contents
4. Introduction to Psychology
5. Guided Meditation
6. Simplified physical exercises instructions
7. Simplified Physical Exercises
8. Life skills and value education
9. James Allen Library

Assessment (Practical course)
Participation, Practical activities and assignments, personal wellness plan and reflection.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr. Ezhilarasi Principal- KCT	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24INP101	DESIGN THINKING (Common to all Departments)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Introduces first-year engineering students to Design Thinking, focusing on practical, user-centered problem-solving techniques
2	Empathize with users, generate ideas, and create models to test and refine their solutions
3	Understand iteration, empathy, and critical reflection to cultivate a creative mindset

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply problem-solving techniques and the Design Thinking process to engineering problems using simple models	Ap
CO 2	Understand user needs through various empathy techniques and develop/refine models iteratively based on user insights.	U
CO 3	Reflect critically on their learning journeys and the emotional demands of problem-solving. Collaborate effectively in teams to develop innovative solutions	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	1		2			2		2			1		
2	1							2			1		
3	1		2			2		1			1		

Course Content

INTRODUCTION TO PROBLEM SOLVING AND GROUND RULES Introduction to problem-solving strategies without mentioning Design Thinking-Emphasize problem-solving attitudes, mindsets, and behaviours necessary for iterative problem solving (e.g., openness to failure, patience, empathy)-Set ground rules for the course, including incentives for creative risk-taking and penalties for non-participation or lack of reflection-Overview of the Design Thinking process and its importance.	**6 Hours**

EMPATHY AND PROBLEM DEFINITION Techniques for understanding user needs, including observation, interviews, **surveys** and **focus groups**-Importance of secondary research as a complement for the above-mentioned methods-Introduction to empathy cycles: involve students in two empathy cycles before and after problem definition-Finetuning problem definition based on user insights.	**6 Hours**
IDEATION AND CONCEPT MODELLING Brainstorming ideas and selecting feasible solution-Creating concept modelling to visualize ideas-Include an empathy cycle after students propose solutions, allowing them to revisit and reshape their solutions based on further insights from users.	**6 Hours**
PROTOTYPING AND TESTING WITH MODELS Building basic prototypes using simple materials (e.g., cardboard, clay)- Introduction to different prototyping methods (e.g., **low-fidelity** vs **high-fidelity models**) for different contexts: product design, space design, policy, and digital/e-commerce solutions-Conduct an empathy cycle after the prototype is developed to gather user feedback and refine the prototype.	**6 Hours**
ITERATION AND FINAL MODELLING PROJECT Students refine their prototypes based on feedback from the empathy cycle-Finalize prototypes for presentation based on consistent feedback loops.	**6 Hours**
PRESENTATION, REFLECTION, AND LEARNING SUMMARIES Students present their final projects and reflect on their learning journeys, including how their understanding of problem-solving and empathy evolved during the course-**Learning Summary Activity:** Each student presents their individual journey and learning outcomes from the empathy cycles and iterations-Peer review and group discussions.	**6 Hours**

Theory Hours:	0	Tutorial Hours:	0	Practical Hours:	30	Project Hours:	0	Total Hours:	30

Learning Resources

Textbooks:

1. Handbook of Design Thinking, Christian Muller – Roterberg, Kindly Direct Publishing
2. The Art of Innovation, Tom Kalley
3. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

Online Resources (Weblinks)

1. Survey and focus group design guides
2. Guidance on Designing, Administering and Analyzing Focus Groups and Interviews
3. Empathy mapping tools
4. How to Make a Concept Model
5. Brainstorming Techniques: 15 Creative Activities
6. 10 Brainstorming Techniques for Developing New Ideas
7. Brainstorming templates
8. 5 Common Low-Fidelity Prototypes and Their Best Practices
9. UX Prototypes: Low Fidelity vs. High Fidelity
10. Low-fidelity vs. High-fidelity Design Prototypes (and when to use which)

Case study 1: Iterative Design and Prototype Testing of the NN/g Homepage

Case study 2: Using iterative design to optimise the user flow of a product

11. Reflective practice toolkit

Assessment
Formative: Assignments, Mini project

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**	
-	-	Dr. Padhmanand Sudhagar R Department of Bio-Tech Dr. Arul H Department of Physics	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

Semester-2

24HST102	தமிழரும் தொழில்நுட்பமும்/ TAMILS AND TECHNOLOGY	L	T	P	J	C
		1	0	0	0	1
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தை அறிமுகப்படுத்துதல், சங்க கால கட்டிட தொழில்நுட்பத்தை விளக்குதல், கோயில்கள் மற்றும் சிற்பக்கலைகளை ஆராய்தல். Introducing weaving and pottery technology of Tamils -Explaining the building technology of the Sangam Period-Explore temples and sculptures.
2	கப்பல், இரும்பு, நாணயங்கள், மணி உருவாக்கும் தொழிற்சாலைகள், ஆகியவற்றை விளக்கம் செய்தல், தமிழகத்தின் தொல்லியல் சான்றுகளின் பழமையை உணர்த்துதல். Explain Ship, Iron, Coins, Beads Making Factories. Realizing the Antiquity of Archaeological Evidence of Tamil Nadu
3	வேளாண்மை மற்றும் அறிவியல் தமிழைப் பற்றி அறிதல், இணையத்தில் தமிழின் தேவையை உணர்த்துதல்,தமிழ் மென்பொருள்களை அறிமுகம் செய்தல். Knowledge of Agricultural and Scientific Tamil, Realizing the need for Tamil on the Internet, Introducing Tamil software.

Course Outcomes:

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தின் முக்கியத்துவத்தினை அறிந்து கொள்ளுதல். சங்ககால தமிழர் வளர்த்த அழகுக் கலைகளைத் தெரிந்து கொள்ளுதல். Know the importance of weaving and pottery technology of Tamils-To know the Aesthetics arts developed by Sangam Tamils	U
CO 2	கப்பல் கட்டும் கலை, இரும்புத் தொழிற்சாலை, நாணயங்கள் அச்சடித்தல், மணி உருவாக்கும் தொழிற்சாலைகள், சிலப்பதிகாரத்தில் உள்ள மணிகளின் வகையை அறிதல். Knowledge of ship building, ironworks, coinage, minting, and beads making factories,Knowing the types of beads in Silapathikaram.	U
CO 3	வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தை அறிந்து கொள்ளல். அறிவியல் தமிழ் மற்றும் கணினித் தமிழைப் புரிந்து கொள்ளுதல்.	Ap

	Know agriculture and irrigation technology. Understanding Scientific Tamil and Computer Tamil.	

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2		2				3	2	2		2		
2	2		2				3	2	2		2		
3	2		2				3	2	2		2		

Course Content

நெசவு மற்றும் பானைத் தொழில்நுட்பம்: சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள். Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW)-Graffiti on Potteries.	**3 Hours**
வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ரூ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் -சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை. Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	**3 Hours**
உற்பத்தித் தொழில் நுட்பம்: கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள்- நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி	

மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் -தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள். Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel-Copper and gold- Coins as source of history - Minting of Coins - Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidence - Gem stone types described in Silappathikaram.	**3 Hours**
வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம்- கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள்- வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம். Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	**3 Hours**
அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள்- சொற்குவைத் திட்டம். Development of Scientific Tamil - Tamil computing- Digitalization of Tamil Books- Development of Tamil Software - Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.	**3 Hours**

Theory	**Tutorial**	**Practical**	**Project**	**Total**
Hours: 15	**Hours: 0**	**Hours: 0**	**Hours: 0**	**Hours: 15**

Reference books

1. தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL- (in print)
6. Social Life of the Tamils the Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tarnils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Textbook and Educational Services Corporation> Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation> Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) - Reference Book.

Online Resources

1. https://www.youtube.com/watch?v=Gp1ratX2sOE&list=PLtyn2o7hocf40PtPibRqJTf_dQL3eOtLl
2. https://www.youtube.com/watch?v=jteRvnNiD6w

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		-
Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HST103	EFFECTIVE COMMUNICATION	L	T	P	J	C
		2	0	0	0	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to

1	Enhance students' abilities to communicate ideas effectively, both orally and in writing, by developing skills in organizing thoughts clearly and logically and expressing them through well-structured paragraphs and concise summaries.
2	Enable students to critically evaluate and synthesize information from multiple sources and utilize suitable writing techniques and formats to produce professional-quality content tailored to various contexts.
3	Foster active listening, critical reading, and reflective thinking, empowering students to create engaging, relevant, and informative content by applying effective communication strategies across diverse platforms.

Course Outcomes

After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO1	Demonstrate proficiency in delivering ideas effectively, both in speaking and writing, with a deeper understanding of the content and the ability to convey complex ideas through well-structured paragraphs and summaries.	Ap
CO2	Create and present original content by evaluating information from multiple sources and employing appropriate formats and writing strategies across various professional contexts.	C
CO3	Produce engaging and informative content through active listening, reading, reflection, and effective communication skills.	E

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**											**Program Specific Outcomes (PSO)**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1							2	2	3		3		
2							2	2	3		3		
3							2	2	3		3		

Course Content	
TEXT ANALYSIS Composition of Coherent Paragraphs (Expository, Descriptive, Narrative, Evaluative) - Loud Reading (Reading Extracts will be given were students identify the main idea of paragraphs or sections and debrief)	**6 Hours**
VISUAL & WRITTEN ANALYSIS Process writing (Drafting effective introduction, process and conclusion using appropriate transition words and phrases) - Describing Visuals (Line graph, Bar Chart, Flow Chart, Pie Chart, Table, Tree diagram) - Note Making & Summarizing	**6 Hours**
PROFESSIONAL CORRESPONDENCE Crafting Professional Emails - Writing Instruction for Manuals – Reading technical documents (Reading extracts will be given to construct sentences from the new words found in the document)	**6 Hours**
RESEARCH AND DOCUMENTATION Library Reading (Identify at least three sources and extract information, Summarize the main ideas and key findings from each source, compile them findings into a brief report that includes the main points, sources, and relevance to the topic)- Report Writing (Title Page, Abstract, Introduction, Methodology, Results, Discussion, Conclusion and recommendation)	**6 Hours**
TALK ANALYSIS AND PODCAST SKILLS Listening to and analyzing TED talks – Preparing Podcast-PRISM (Professional Rhetoric Improvement and Speech Mastery) to share facts, opinions and experiences - Writing Reviews on products.	**6 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 30

Learning Resources
References:
1. Swamy, V. R. Narayana. Strengthen Your Writing. Orient Longman, 2003. 2. Sasikumar, V., and P. V. Dhamija. Spoken English: A Self-Learning Guide to Conversation Practice. Tata McGraw Hill, New Delhi (1993). 3. Maison, Margaret M. Examine Your English. Orient Longman, 1999. 4. Rizwi, Ashraf. Effective Technical Communication. Tata McGraw Hill, 2005. 5. Pickett, Nell Ann, and Ann A. Laster. Technical English: Writing, Reading, and Speaking. **6.** Harpercollins College Div, 1993.
Online Resources (Weblinks)
1. https://owl.purdue.edu/owl/general_writing/academic_writing/paragraphs_and_paragraphing/index.html 2. https://learnenglish.britishcouncil.org/skills/writing/upper-intermediate b2/describing-trends 3. https://hbr.org/2016/07/how-to-write-email-with-military-precision 4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports and_memos/index.html

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore		Dr. Arokia Lawrence Vijay Dr. Sreejana Dr. Tissaa Department of English
Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

24HST104	PROFESSIONAL COMMUNICATION (Common to all Departments)	L	T	P	J	C
		2	0	0	0	2
HS		SDG	4, 8			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to

1	Develop students' abilities to craft clear, concise, and well-structured technical content and professional communications
2	Enhance students' communication skills in team settings
3	Equip students with cross-cultural communication skills and effective listening techniques

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Demonstrate proficiency in crafting clear, concise, and well-structured technical content and professional communications, including emails that meet industry standards.	Ap
CO2	Communicate effectively in team settings, showcasing collaboration, conflict resolution, and leadership skills, while employing creative writing techniques to convey complex ideas.	An
CO3	Apply principles of cross-cultural communication and effective listening techniques to engage successfully in diverse, globalized professional environments.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1						2	1	3	1		3		
2						2	3	3	2		3		
3						1	1	3	1		3		

Course Content

MASTERING PROFESSIONAL COMMUNICATION Industry-specific terminology (Business / Technical Register) - Crafting professional emails - Essential elements of an effective email (subject line, salutation, body, closing) - reading and responding to email communication – Networking Emails - Analyzing and interpreting technical texts (Loud Reading).	**6 Hours**

NAVIGATING DIGITAL MEDIA Introduction to Digital media and online communication tools (instant messaging, video conferencing, social media, blogs, forums) - Listening and analyzing advanced audio materials - Creative & Blog Writing (General & Technical).	**6 Hours**
TECHNICAL WRITING TECHNIQUES Writing Reflective Essays / Experience Sharing, Process writing, Transcoding graphics (interpreting technical texts), Writing Reviews (Research Articles & Books).	**6 Hours**
BUILDING A PROFESSIONAL DIGITAL PRESENCE Creating Digital Profile - Overview of different digital platforms (LinkedIn, GitHub, personal websites) - Setting Up a LinkedIn Profile – Crafting a Video Resume – Digital Etiquette and Professionalism - Cross-cultural communication and diversity awareness.	**6 Hours**
SOCIAL RESPONSIBILITY IN PRACTICE Environmental and social responsibilities - Case studies and real-world applications - Project Work - Writing Project reports.	**6 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 30

Learning Resources

Reference books

1. Baker, W., & Ishikawa, T. Transcultural Communication Through Global Englishes: An Advanced Textbook for Students. Routledge, 2021.
2. Bodnar, O., Fedak, S., Hinsirovska, I., Denysiuk, N., Perenchuk, O., Plavutska, I., ... & Shchur, N. English for Study and Work: A Coursebook In-class Activities. 2017.
3. Doff, A., Thaine, C., Puchta, H., Stranks, J., & Lewis-Jones, P. Cambridge English Empower Advanced Student's Book. Cambridge University Press, 2016.
4. Hewings, M., Thaine, C., & McCarthy, M. Cambridge Academic English C1 Advanced Student's Book: An Integrated Skills Course for EAP. Cambridge University Press, 2012.
5. Beer, D. F., & McMurrey, D. A. A Guide to Writing as an Engineer. John Wiley & Sons, 2019.

Online Resources (Web Links)

1. https://hbr.org/2016/07/how-to-write-email-with-military-precision
2. https://ocw.mit.edu/courses/comparative-media-studies-writing/21w-732-scientific-and-technical-communication-spring-2015/
3. https://www.coursera.org/learn/digital-media
4. https://owl.purdue.edu/owl/subject_specific_writing/professional_technical_writing/reports_and_memos/index.html

Assessment (Theory course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University, Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Hema Department of English

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24MAI121	ADVANCED CALCULUS AND LAPLACE TRANSFORMS (Common to AE, AU, ME, MR)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9			

Pre-requisite courses	24MAI111/ Linear Algebra and Calculus	Data Book / Codes books (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Utilize gradient, divergence, and curl, along with Green's, Stokes', and Gauss' theorems to solve complex vector calculus problems.
2	Focus on first order and higher-order linear ordinary differential equations, including Bernoulli's and Leibniz's equations, relevant to engineering contexts.
3	Use Laplace transforms to solve linear ordinary differential equations of second order and understand the behavior of simple and periodic functions.
4	Explore Cauchy-Riemann equations for analytic functions and construct these functions using the Milne-Thomson method
5	Employ the residue theorem to determine complex integrals and resolve real definite integrals effectively.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply gradient, divergence, and curl to solve vector calculus problems using Green's, Stokes', and Gauss' theorems.	Ap
CO 2	Analyse first-order linear ordinary differential equations like Leibnitz's and Bernoulli's equations and higher-order linear homogeneous ordinary differential equations in engineering applications.	An
CO 3	Apply the properties of Laplace transforms to solve simple and periodic functions	Ap
CO 4	Apply Laplace transforms to solve linear ordinary differential equations of second order.	Ap
CO 5	Analyse analytic functions using Cauchy-Riemann equations and construct analytic functions using Milne-Thomson method.	An
CO 6	Determine complex integrals and apply the residue theorem to solve real definite integrals.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
ourse Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2			2								

2	2	3	1		1								
3	2	2			2								
4	2	2		1	2								
5	3	2		2	2								
6	3	2			2								

Course Content

VECTOR CALCULUS Gradient, divergence, and curl, Line integrals, Green's theorem –Stoke's theorem – Gauss divergence theorem (without proofs) **Practical Component** • Evaluating gradient, divergence and curl. • Evaluating line integrals and work done. • Verifying Green's theorem in the plane.	**9 Hours** **9 Hours**
ORDINARY DIFFERENTIAL EQUATIONS Leibnitz's equation – Bernoulli's equation – Linear equations of higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters. **Practical Component** • Solving of second and higher order ordinary differential equations.	**9 Hours** **3 Hours**
LAPLACE TRANSFORMS Definition - Properties: Superposition, Shift in t or Time Delay, Shift in s, Time Derivatives, Time Integral – Initial Value Theorem – Final Value Theorem - Transform of periodic functions - Inverse transforms – Convolution theorem – Solution of linear ordinary differential equations of second order with constant coefficients. **Practical Component** • Evaluating Laplace transforms and inverse Laplace transforms of functions. • Applying the technique of Laplace transform to solve differential equations.	**9 Hours** **6 Hours**
ANALYTIC FUNCTIONS Functions of a complex variable – Analytic functions – Necessary and sufficient conditions in Cartesian coordinates, Cauchy – Riemann equations (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method **Practical Component** • Verifying the analyticity of a function. • Construction of analytic functions by Milne Thomson method.	**9 Hours** **6 Hours**
COMPLEX INTEGRATION Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series – Singularities and zeros –Residues –Residue theorem –Application of residue theorem for evaluation of real definite integrals. **Practical Component** • Verification of Cauchy's integral formula and integral theorem. • Evaluation of real definite integrals using Complex integration.	**9 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45thEdition, 2020.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2018.
3. Kreyzig E., "Advanced Engineering Mathematics" International students' version, 10th Edition, John Wiley and sons, 2023.

Reference books

1. Veerarajan T., "Engineering Mathematics (for First Year)", Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2008.
2. Weir, MD, Hass J, Giordano FR, "Thomas' Calculus", Pearson education 15th Edition, 2022.
3. G.B. Thomas and R.L. Finney, "Calculus and Analytical Geometry", 11th Edition, Pearson Education, 2006.
4. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 9th Edition, New Delhi, 2020.

Online Resources (Weblinks)

1. **Multivariable Calculus by MIT OpenCourseWare (Free)**
   https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/
2. **Khan Academy: Multivariable Calculus (Free)**
   https://www.khanacademy.org/math/multivariable-calculus
3. **Coursera: Introduction to MATLAB Programming by Vanderbilt University**
   https://www.coursera.org/learn/matlab

Assessment

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. Mr. Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. Mr. Imran Khan, GE Transportation Company, Bangalore.	Dr. T. Govindan, Government College of Engineering, Srirangam, Trichy. Dr. C. Porkodi, PSG College of Technology, Coimbatore. Dr. P. Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.	Dr. S.MeenaPriyadarshini Dr.K.Maheswari Ms. A.Shamugavadivu Department of Mathematics

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24CYI104	MATERIAL CHEMISTRY (Common to AE, AU, ME)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	7, 9, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental principles of nano chemistry and its applications in aerospace and automotive industries, focusing on size-dependent properties of nanomaterials.
2	Explore alloys, phase diagrams, and materials processing techniques used in high-performance automotive and aerospace components.
3	Analyze electrochemical principles and corrosion mechanisms with an emphasis on prevention strategies for engineering systems.
4	Investigate advanced engineering materials such as composites, smart materials, and high-performance lubricants used in various mechanical systems.
5	Study sustainable fuels, emission control technologies, and environmental impact assessment for aerospace and automotive applications.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply fundamental nano chemistry concepts to distinguish between nanoparticles, molecules, and bulk materials.	Ap
CO 2	Analyze various synthesis methods, such as sol-gel and laser ablation, to identify their applications in nanomaterial production.	An
CO 3	Apply the properties of carbon nanotubes and graphene to demonstrate their significance in aerospace and automotive applications.	Ap
CO 4	Analyze phase diagrams to interpret key reactions in advanced alloy systems used in engineering.	Ap
CO 5	Analyze different corrosion prevention techniques to determine the most effective methods for material protection in aerospace and automotive systems.	An
CO 6	Evaluate new material combinations using 3D printing technologies for customized mechanical parts and aerospace components.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2			2		2				2		

2	3	2	2										
3	3			2			2						
4	3		2						2				
5							2			2	2		
6	2			3	1	1	2	2		2	1		

Course Content

NANO CHEMISTRY Introduction to nano chemistry - Distinction between molecules, nanoparticles, and bulk materials - Size-dependent properties of nanomaterials. Synthesis methods: Sol-gel, solvothermal - chemical vapor deposition - laser ablation. Carbon nanotubes and Graphene: Applications in lightweight aerospace structures - automotive body panels - high-strength mechanical components. Nanowires and Nanocomposites: Applications in sensors for engine diagnostics, reinforced aircraft panels, and wear-resistant automotive coatings. **Practical Component:** • Preparation of Standard solutions. • Synthesis of Nanoparticle using Solvothermal Method. • Determination of conductance of nano coated objects	**9 Hours** **6 Hours**
ALLOYS, PHASE RULE AND MATERIALS PROCESSING **Alloys:** Introduction - Solid solutions, Substitutional and Interstitial alloys - Advanced alloys: Lightweight automotive frames (Advanced high-strength steels (AHSS)), and high-temperature engine components (Titanium Aluminides (TiAl)). **Phase diagrams:** Identification and Interpretation of Eutectic, Peritectic, Eutectoid, Peritectoid reactions in alloy systems for engineering applications **Powder Metallurgy:** Preparation and Applications in gears for automotive transmissions, aircraft brake components, and custom-shaped mechanical parts. **Additive manufacturing:** 3D printing of complex aerospace components, customized automotive parts, and rapid prototyping for mechanical systems - Process parameters and material properties. **Practical Component:** • Estimation of metal ion solution by Spectrophotometry • Estimation of copper content in brass by Complexometric method • Investigation of Phase Transitions in Ethylene Glycol ($C_2H_6O_2$) to understand its role as an Antifreeze and Coolant in Automotive Applications Through Phase Diagram Analysis	**9 Hours** **6 Hours**
ELECTRO CHEMISTRY AND CORROSION Electrochemical principles: Electrode potential and electrochemical series - Concentration cells and their applications in fuel cell sensors for vehicles. Corrosion: Chemical corrosion - Electrochemical corrosion - Forms of corrosion: Galvanic corrosion in multi-material aircraft structures - pitting corrosion in automotive exhaust systems - intergranular corrosion in heat-affected zones of welded mechanical components - stress corrosion cracking in aerospace fasteners – Factors Influencing Corrosion	**9 Hours**

Corrosion prevention strategies: Cathodic protection for underground fuel tanks - Anodic protection for chemical storage vessels – Anodising - Protective coatings for aircraft exteriors and mechanical systems - Failure analysis and prevention **Practical Component:** • Determination of electrode potentials of the cell and construct feasible cell. • Measurement of rate of corrosion on zinc/mild steel by weight loss method • Estimation of metal ion solution using potentiometric titration	**6 Hours**
ADVANCED ENGINEERING MATERIALS High-performance lubricants: Properties and Applications in high-temperature aircraft engines, long-life automotive transmissions, and precision mechanical bearings - Synthetic lubricants - Nano lubricants. Composite materials: Polymer matrix composites in aircraft fuselages - metal matrix composites in automotive brake rotors - ceramic matrix composites in gas turbine components - Fabrication techniques and mechanical properties. Smart materials: Shape memory alloys in aircraft actuators - piezoelectric materials in fuel injectors, - magnetorheological fluids in adaptive automotive suspensions. **Practical Component:** • Determination of Viscosity of Lubricants • Determination of cloud and pour point of Lubricants • Determination of Flash and Fire point of Lubricants	**9 Hours** **6 Hours**
SUSTAINABLE FUELS AND COMBUSTION TECHNOLOGY Introduction to alternative fuels: Biofuels for aviation - hydrogen fuel cells in automotive applications - natural gas for long-haul transportation - Advantages and challenges. Advanced biofuels: Cellulosic ethanol for automotive use - algal biofuels for aviation - synthetic biofuels for rocket propulsion - Hydrogen production, storage, and utilization in fuel cell vehicles Emission characteristics and control technologies (catalytic converters and particulate filters) - Environmental impact assessment of fuels in commercial aviation and automotive fleets - Regulations and standards for emissions control - Future trends. **Practical Component**: • Extraction of Biofuel from vegetable oil by saponification method. • Determination of Calorific Value of Biofuels. • Determination of Viscosity of Biofuel	**9 Hours** **6 Hours**

Theory Hours:	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours:
45	0	30	0	75

Learning Resources

References:

1. Mishra, M., & Singh, P. (2017). Nanotechnology: Principles and practices. New Age International Publishers.
2. Kumar, C. S. S. R., & Mohan, Y. K. (2012). Nanotechnology: Principles and practices. Wiley-VCH.

3. Huang, Y., & Wu, T. (2014). Nanomaterials: Synthesis, characterization, and applications. Wiley.
4. Callister, W. D., & Rethwisch, D. G. (2020). Materials science and engineering: An introduction (10th ed.). Wiley.
5. Wulff, J. E., & Kuntz, D. R. (2006). Powder metallurgy: Science, technology, and applications. Springer.
6. Jain, P. C., & Jain, M. (2017). Engineering chemistry (16th ed.). Dhanpat Rai Publishing Company.
7. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2017). Principles of physical chemistry. Vishal Publishing Co.
8. Rangwala, S. C. (2009). Engineering materials. Charotar Publishing House.
9. Rajput, R. K. (2006). Engineering materials. S. Chand & Company Ltd.
10. Atkins, P., & de Paula, J. (2009). Atkin's physical chemistry (9th ed.). Oxford University Press.
11. Singh, A., & Gupta, R. (2018). Advanced functional materials: Applications in engineering and technology. Narosa Publishing House.
12. Sarkar, S. (2009). Fuels and combustion (3rd ed.). Orient Longman.
13. Dara, S. S., & Umare, S. S. (2014). A textbook of engineering chemistry. S. Chand and Company Limited.
14. Rao, S. S. (2010). Engineering materials: Properties and applications of metals and alloys. Narosa Publishing House.
15. Mukhopadhyay, A. K., & Pandey, K. N. (2010). Composite materials: Science and engineering. Narosa Publishing House.
16. Davies, G. J. (2012). Materials for automobile bodies (2nd ed.). Butterworth-Heinemann.
17. Demirbas, A. (2008). Biofuels: Securing the planet's future energy needs. Springer.
18. Roco, M. C., & Bainbridge, W. S. (2018). Nanotechnology research directions for societal needs in 2020: Retrospective and outlook. Springer.

Online Resources (Weblinks)

- https://www.youtube.com/watch?v=qDnzI05vvSc&list=PLMlC7Vx5awsenMs5y02xcW6i5NmdEIRGx
- https://www.youtube.com/watch?v=2rxbxNem1iI&list=PLyqSpQzTE6M_ON8uXt-PP8uX6hMWJeYSJ
- https://www.youtube.com/watch?v=mYGfyO3sPxk&list=PLyqSpQzTE6M9PegzhuWS5Vt4dffN_Rgy8&index=2
- https://www.youtube.com/watch?v=RYdbG4K6DwQ
- https://www.youtube.com/watch?v=Fyq4Q5yWDDU&list=PLyqSpQzTE6M927gXIZdVbbsyj9cmxam-b

Assessment (Embedded course)

CAT, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. Muthuraja Perumal General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	Dr. Venkatakrishnan Professor, School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India		Dr. R. Mayildurai, Department of Chemistry
Recommended by BoS on	16.08.2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24MET104	ENGINEERING MECHANICS (Common to AE, AU, CE, ME, MR)	L	T	P	J	C
		3	0	0	0	3
ES		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Apply principles of equilibrium to analyse rigid body systems in 2D space
2	Calculate geometry-dependent properties such as centroid and moments of inertia
3	Analyse the effects of friction in mechanical systems
4	Understand the kinematics and kinetics of rigid bodies in plane motion

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze the principles of transmissibility and moments to determine equilibrium conditions in rigid bodies.	Ap
CO 2	Evaluate the geometry-dependent properties like center of gravity and moment of inertia to assess their impact on mechanical systems	Ap
CO 3	Examine the laws of friction to distinguish between different types of friction in practical scenarios.	An
CO 4	Analyze and solve problems related to the kinematics of rigid bodies in plane motion	An
CO 5	Apply Newton's laws and principles of kinetics to solve problems involving the motion of rigid bodies.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3					2							
2	3					2							
3	3					2							
4	3					2							
5	3					2							

Course Content	
STATICS OF RIGID BODIES Resolution of a Force into Components, Free body diagram. Equivalent systems of forces acting on a rigid body in 2D space: Principle of transmissibility – Moment of force about a point – Varignon's theorem – Moment of a couple – Equivalent couple –Moment of force about an axis – Coplanar non-concurrent forces acting on rigid bodies – Resultant and equilibrium – Resolution of a given force into force couple system – Equilibrium of a rigid bodies 2D space – Reactions and supports. Analysis of structures.	**9 Hours**
GEOMETRY DEPENDENT PROPERTIES Centre of gravity, Centre of mass and Centroid – Moment of Inertia of simple and complex areas – Transfer formula – Radius of gyration – Polar moment of inertia – Product of inertia - Mass moment of Inertia of simple solids, thin plates, composite bodies.	**9 Hours**
FRICTION Laws of friction – coefficient of friction – Dry friction – wedge friction – ladder friction – rolling resistance. Applications of friction by analytical approach in belt drives (open belt drive), clutches (plate and cone clutches), brakes (single shoe brake)	**9 Hours**
KINEMATICS OF RIGID BODIES - PLANE MOTION Kinematics of rigid bodies: Plane motion, translation and rotation **General plane motion:** Absolute velocity, relative velocity, instantaneous centre of rotation, absolute acceleration, relative acceleration.	**9 Hours**
KINETICS OF RIGID BODIES - PLANE MOTION Equations of motion of a rigid body - angular momentum, D'Alembert's principle; Principle of work and energy for a rigid body, work of forces acting on a rigid body, kinetic energy of a rigid body in plane motion, conservation of energy; Impulse-momentum principle for the plane motion of a rigid body; Overview of Lagrange's equations of motion.	**9 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 45

Learning Resources

Textbooks

1. Ferdinand P. Beer, Jr. Johnston, E. Russell, Mechanics for Engineers: Statics and Dynamics, McGraw-Hill Inc.,US (1987).
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 15th edition, Prentice Hall, 2022

Reference books

1. Beer, Ferdinand P., E. Russell Johnston, David Mazurek, Phillip Cornwell, and Brian Self. *Vector Mechanics for Engineers: Statics and Dynamics*. 2024 ed. New Delhi: Tata McGraw-Hill, 2024. ISBN 9781260710892.
2. .James L. Meriam, L. G. Kraige, J. N. Bolton: Engineering Mechanics Statics , 9th edition, Wiley student edition, 2020.
3. James L. Meriam, L. G. Kraige, J. N. Bolton: Engineering Mechanics: Dynamics, 9th edition, Wiley student edition, 2020.
4. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
5. Irving H. Shames, G. Krishna Mohana Rao, Engineering Mechanics - Statics and Dynamics, Fourth Edition – PHI / Pearson Education Asia Pvt. Ltd., 2006.

6. Rajasekaran S and Sankarasubramanian G, “Engineering Mechanics-Statics and Dynamics”, Vikas Publishing House Pvt. Ltd., New Delhi, 2006

Assessment (Theory course)
CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert from Industry	**Expert from Higher Education Institution**	**Internal Expert**	
Mr. Babin. T, Design Engineer Lead |Mechanical Product Design Engineer-III at SLB, Singapore.	Dr S Parimala Murugaveni Associate Professor, Department of Mechanical Engineering, Government College of Technology, Coimbatore.	Dr. N. Sangeetha, Associate Professor, Department of Mechanical Engineering	
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24PHT107	MATERIALS SCIENCE FOR AERONAUTICAL ENGINEERING	L	T	P	J	C
		3	0	0	0	3
ES		SDG	9			

Pre-requisite courses	Engineering Physics	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental concepts of crystal structures and imperfections.
2	Gain knowledge of aircraft materials and their applications.
3	Understand the strengthening mechanisms and high-temperature material performance.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse using basic concepts of crystal structures and explain the impact of crystal imperfections on material properties.	An
CO 2	Analyse the general properties and selection criteria of aerospace materials and state their application in aircraft structures.	An
CO 3	Analyse by applying knowledge of aircraft metal alloys and superalloys to assess their suitability for various aerospace applications.	An
CO 4	Analyse by applying the mechanisms of material strengthening to interpret and differentiate between brittle and ductile fracture mechanisms at the application	An
CO 5	Apply knowledge of mechanical and thermal properties in high-temperature materials to state how well they meet the requirements for aerospace applications."	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2									2		
2	3										2		
3	3		2								2		
4	3	2									2		
5	3										2		

Course Content	
FUNDAMENTALS OF CRYSTAL STRUCTURES Space lattice – unit cell – lattice planes – Bravais space lattices – Miller indices – calculation of interplanar distances – atomic radius – co- ordination number – packing factor for SC, BCC, FCC and HCP structures. Crystal imperfections: point defects – line defects – surface defects – volume defects – effect of crystal imperfections.	**9 Hours**
INTRODUCTION TO AIRCRAFT MATERIALS General properties of materials, Requirements of aircraft materials, Application trends in aircraft structures and engines, Introduction to smart materials (SMAs), Selection criteria of materials for use in aircraft. Ablation process, ablative materials and applications in aerospace – Phenomenon of super conduction, super conducting materials and applications in aerospace (Qualitative only).	**9 Hours**
AIRCRAFT METAL ALLOYS AND SUPERALLOYS Aluminium alloys, Magnesium alloys, Titanium alloys, Plain carbon and Low carbon Steels, Corrosion and Heat-resistant steels, Maraging steels, Copper alloys, Producibility and Surface treatments for each of the above – Super alloys, Nickel based super alloys, Cobalt based super alloys, and Iron based super alloys, manufacturing processes associated with super alloys, Heat treatment and surface treatment of super alloys.	**9 Hours**
STRENGTHENING OF MATERIALS Strengthening mechanisms for the improvement of mechanical properties - cold working precipitation hardening, solute hardening and diffusion hardening - Fracture-Mechanism of brittle fracture (Griffith's theory) and Ductile fracture - difference between brittle and ductile fracture - fatigue failure and its prevention - creep different stages in creep curve-Factors affecting mechanical properties Grain size and heat treatment.	**9 Hours**
HIGH TEMPERATURE MATERIALS & CHARACTERIZATION Classification, production and characteristics – Methods and testing – Determination of mechanical and thermal properties of materials at elevated temperatures – Application of these materials in Thermal protection systems of Aerospace vehicles – High temperature material characterization.	**9 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours: 45

Learning Resources

Textbooks:

1. Pillai, S.O., Solid State Physics, New Age International Publication, New Delhi (2022).
2. Gaur, R.K., and Gupta, S.L., Engineering Physics, Dhanpat Rai Publications (P) Ltd., New Delhi (2016).
3. Raghavan, V., Materials Science and Engineering, Prentice Hall of India, New Delhi (2015)

References:

1. Avadhanalu, M.N., and Kshirsagar, P.G., A Textbook of Engineering Physics, S. Chand & Company Ltd., New Delhi (2019).
2. Van Vlack, L.H., Elements of Material Science and Engineering, Pearson Education India (2008).
3. Callister, W.D., Jr., Materials Science and Engineering: An Introduction, John Wiley and Sons Inc., New York (2018).
4. Titterton, G., Aircraft Materials and Processes, Pitman Publishing Co., London (1998).
5. Martin, J.W., Engineering Materials: Their Properties and Applications, Wykedham Publications (London) Ltd., London (1987).

Online Resources (Weblinks)
1. https://archive.nptel.ac.in/courses/112/106/112106293/ 2. https://archive.nptel.ac.in/courses/101/104/101104010/ 3. https://archive.nptel.ac.in/courses/113/106/113106101/ 4. https://ntrs.nasa.gov/404?original=%2Fcitations%2F20060024092\

Assessment (Theory course)
CAT, Mini project, Qualitative assignments (PrBL/Activity based), Real case studies about aircraft structures and materials, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
		Fg Offr.Dr R Sengodan Dr M Selvambikai Department of Physics	
Recommended by BoS on	16.08.2024		
Academic Council Approval	No:27	**Date**	24.08.2024

24CSI101	LOGICAL THINKING AND PROBLEM SOLVING (Common to all Programmes)	L	T	P	J	C
		3	0	2	0	4
ES		SDG	8, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Gain a comprehensive understanding of computing systems, including their classification, processing units, memory structures, storage hierarchies, and the essential functions and types of operating systems
2	Develop strong logical and analytical thinking skills, enabling the systematic analysis and solution of computational problems using reasoning techniques, algorithms, and flowcharts.
3	Acquire a solid foundation in C programming, mastering the use of data types, operators, control structures, and input/output operations to create efficient and effective programs.
4	Apply advanced programming techniques, including the use of arrays, structures, pointers, and functions, to solve complex real-world problems with a focus on modular and efficient coding practices.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Understand the basic concepts of hardware, software, Operating systems, and the logic behind the functioning of the Computing systems.	U
CO2	Apply logical thinking and reasoning to solve computing problems using tools like algorithms and flowcharts.	Ap
CO3	Understand the structured programming paradigms, memory organization and how the language can be used as a tool to solve problems.	U
CO4	Develop simple programs using data types, operators, control structures, pointers, and functions as appropriate in real world applications.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2												
2	3	2	1									3	
3		1										2	
4	3	2	1									3	

Course Content	
FUNDAMENTALS OF COMPUTERS AND COMPUTING Generations of computers, and classification of computers (supercomputers, mainframes, minicomputers, microcomputers). Processing Units (CPU, GPU, TPU), memory (RAM, ROM), storage devices and hierarchy, input / output and peripheral devices. System software, application software. Operating Systems - Functions (process management, memory management, file system management, device management, security), types of operating systems (desktop, mobile, networking, distributed, real-time, embedded). **Number Systems**: Introduction to different number systems (binary, octal, decimal, hexadecimal), conversions between number systems, and binary arithmetic (addition, subtraction, multiplication, division). **Practical Component** Exploring hardware and software components	**6 Hours** **4 Hours**
LOGICAL THINKING, REASONING AND TOOLS Problem Analysis **–** Logical Thinking vs Critical Thinking vs Design Thinking - Inference – Inductive Reasoning – Deductive Reasoning **– Logical Thinking Tools: Algorithms**: Definition and importance, characteristics of algorithms (finite, clear and unambiguous, well-defined inputs and outputs, feasible). Algorithm representation Techniques: Pseudocode, stepwise refinement, and top-down design. **Flowcharts**: Symbols used in flowcharts, creating flowcharts, and examples of flowchart-based problem-solving. **Practical Component** Algorithm writing and Flowcharts,	**8 Hours** **4 Hours**
PROGRAMMING PARADIGMS AND INTRODUCTION TO C PROGRAMMING **Programming Paradigms**: Structured programming - functional programming - object-oriented programming. **Introduction to C Programming**: History of C - features of C - structure of a C program – input / output statements. **Data Types**: Primitive data types (int, char, float, double) - derived data types, typecast. **Operators**: Arithmetic operators - relational operators - logical operators - bitwise operators - assignment operators - operator precedence. **Conditional Statements**: If - if-else - nested if - switch-case. **Looping Statements**: For loop - while loop - do-while loop. Pre-processor Directives and Command line arguments, Storage Classes. **Practical Component** Programs on Operator precedence, Decision Making, Iterations	**11 Hours** **10 Hours**
ARRAYS AND STRUCTURES **Collections**: Arrays – 2D Arrays – String Manipulation. **Structures and Unions**: Definition - declaration - accessing members - differences between structures and unions - applications. **Practical Component** Programs on Arrays, Structures, Union,	**10 Hours** **6 Hours**
POINTERS AND FUNCTIONS **Pointers**: Definition - declaration - pointer arithmetic - pointers and arrays. **Functions**: Definition - declaration - types of functions (user-defined, library functions) - parameter passing (by value, by reference) pointers and functions, recursion. **Practical Component** Pointers and Functions. Additional programs on Files to be discussed.	**10 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks:

1. Kanetkar, Yashavant. Let Us C. BPB Publications, New Delhi (2023).
2. Rajaraman, V. Fundamentals of Computers. PHI Learning, New Delhi (2020).
3. Dromey, R.G. How to Solve it by Computer. Prentice Hall International, New York (2008).

Reference

1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to Algorithms. MIT Press, Cambridge (2022).
2. Balagurusamy, E. Programming in ANSI C. McGraw Hill Education, New York (2021).
3. Kernighan, Brian W., and Dennis M. Ritchie. The C Programming Language. Prentice Hall, New York (2017).
4. Patterson, David A., and John L. Hennessy. Computer Organization and Design: The Hardware/Software Interface. Morgan Kaufmann, San Francisco (2017).

Online Resources (Weblinks)

1. https://nptel.ac.in/courses/106105214
2. https://www.coursera.org/learn/computer-fundamentals
3. https://www.khanacademy.org/computing/computer-science/algorithms
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/
5. https://www.geeksforgeeks.org/c-programming-language/

Assessment (Embedded course)

CAT, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)
Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	-	Dr. S. Kavitha, Department of Information Technology

Recommended by BoS on	16.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24INP103	INNOVATION PRACTICUM – II (Common to All branches)	L	T	P	J	C
		0	0	2	0	1
ES		SDG	9, 11, 12			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	Equip students with essential tools and techniques for leveraging open-source technologies to develop proof-of-concepts and prototypes
2	Provide hands-on experience and participants will gain a comprehensive understanding of the entire product development process
3	Final prototyping, empowering them to transform their ideas into tangible outcomes

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyse the effectiveness of various electronic tools and techniques in product development processes	An
CO 2	Develop and implement functional software prototypes using open-source tools	Ap
CO 3	Design and fabricate 3D models using digital fabrication techniques	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	2	2	2								
2	2	2	2		2								
3	2	2	3	2	2								

Course Content

INTRODUCTION TO OPEN-SOURCE TOOLS AND TECHNIQUES Explore the concept of open-source, its underlying principles and its contrast with proprietary software, Discuss the advantages of using open-source tools, such as lower costs, increased innovation, educational value, and community support, walk through to the commonly used open-source tools for electronics design (KiCad, FreeCAD), software development (Python, Eclipse), and fabrication (Cura, LinuxCNC).	**3 Hours**
ELECTRONICS FUNDAMENTALS AND TOOLS Introduction to basic electronic components (resistors, capacitors, transistors, etc.), Understanding of electronic circuits and their functions, Hands-on practice with CircuitJS and Falstad, Simulating and analysing electronic circuits, Introduction to Arduino and Raspberry	**6 Hours**

Pi, exploring their capabilities and applications, Designing PCBs using KiCad and EasyEDA, Understanding PCB fabrication processes	
SOFTWARE PROTOTYPING AND TOOLS Benefits of rapid prototyping in product development, Iterative design and testing, Wireframing tools (Balsamiq, Figma), UI design tools (Sketch, Figma), Programming languages (Python, JavaScript), Testing frameworks (Selenium), No-code platforms (Bubble, Adalo, Wix, AppGyver), Building functional prototypes without extensive coding	**6 Hours**
FABRICATION AND PROTOTYPING Overview of fabrication techniques (3D printing, laser cutting, CNC machining), Prototyping methods for physical products, using tools like Blender, TinkerCAD, or Fusion 360, Creating 3D models for physical prototypes, Hands-on experience with laser cutting and engraving, Understanding their applications and limitations	**7 Hours**
SIMULATION & DEMONSTRATION Integrated project demonstration, explaining the design process, technical choices, and outcomes, simulation showcase to demonstrate their understanding of various technical tools and prototyping techniques	**8 Hours**

Theory Hours:	**0**	**Tutorial Hours:**	**0**	**Practical Hours:**	**30**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. Damir Godec, Joamin Gonzalez-Gutierrez, Axel Nordin, Eujin Pei, Julia Ureña Alcázar, A guide to additive manufacturing, Springer – 2022. https://doi.org/10.1007/978-3-031-05863-9
2. Introducing SolidWorks, Dassault Systems.

References:

1. Insight into Electronics
2. Microcontroller Programming with Arduino and Python
3. Fundamentals of 3D modelling

Online Resources (Weblinks)

1. Google Play store apps:
   a. https://play.google.com/store/apps/details?id=com.electronicslab
   b. https://play.google.com/store/apps/details?id=it.android.demi.elettronica
2. https://engservices-ece.sites.olt.ubc.ca/files/2020/01/SolidWorks-3D-Printing-Tutorial-R2.pdf

Assessment (Practical course)

Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert from Industry	Expert(s) from Higher Education Institution	Internal Expert
Dr. Mahesh Veezhinathan Director - Innovation Practicum Associate VP - Forge. Innovation	-	Dr. Samuel Ratna Kumar P S Assistant Professor – III Department Mechanical Engineering

Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

24HSP112	HOLISTIC WELLNESS-II (Common to all Departments)	L	T	P	J	C
		0	0	2	0	1
HS		SDG	3, 4			

Pre-requisite courses	Holistic Wellness-I	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Build on the foundation laid in Holistic Wellness -I and deepening into the practices and principles of holistic wellness.
2	Explore advanced techniques in mental, emotional, and spiritual well-being, with an emphasis on creating sustainable wellness habits.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply advanced techniques in mindfulness, meditation, and stress management.	Ap
CO 2	Understand the role of community and social connections in wellness.	U
CO 3	Develop resilience and adaptability in maintaining wellness.	E
CO 4	Refine and sustain a personalized holistic wellness plan.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1						2		2					
2						2							
3						2					3		
4						2					3		

Course Content

ADVANCED MINDFULLNESS AND MEDITATION: • Deepening mindfulness practices for enhanced mental clarity. • Exploring different forms of meditation (e.g., guided, transcendental, movement-based). • Hands-on activity: Daily meditation practice and journaling reflections.	**6 Hours**
EMOTIONAL RESILIENCE AND MENTAL HEALTH: • Building emotional resilience through positive psychology practices.	**6 Hours**

• Cognitive-behavioural strategies for managing stress and anxiety. • Hands-on activity: Developing and practicing a resilience toolkit.	
SOCIAL AND ENVIRONMENTAL WELLNESS: • The impact of social connections and community on wellness. • Creating a supportive environment for personal growth. • Hands-on activity: Building a community wellness project or group activity.	**6 Hours**
INTERNAL GROWTH AND PURPOSE: • Exploring the deeper aspects of internal wellness and self-actualization. • Reflective practices for discovering life purpose and meaning. • Hands-on activity: Creating a vision board or personal mission statement.	**6 Hours**
SUSTAINING WELLNESS PRACTICES: • Strategies for maintaining wellness habits over the long term. • Adapting wellness plans to life changes and challenges. • Hands-on activity: Revising and finalizing a long-term personal wellness plan.	**6 Hours**

Theory Hours: 0	**Tutorial Hours: 0**	**Practical Hours: 30**	**Project Hours:**	**Total Hours: 30**

Learning Resources

Textbooks:

1. Hanh, Thich Nhat. The Miracle of Mindfulness: An Introduction to the Practice of Meditation. Beacon Press, Boston (1975).
2. Tolle, Eckhart. The Power of Now: A Guide to Spiritual Enlightenment. New World Library, Novato (1997).
3. Patel, Kamlesh. Heartfulness Way: Heart-Based Meditations for Spiritual Transformation, Kamlesh Patel, 2018.

References:

1. Goleman Daniel., Emotional Intelligence., Bloomsbury India, India, (2021).
2. James Allen., As a Man Thinketh., Maple Press, Noida, (2010)
3. Swami Budhanandha., Will power and its development., Advaita Ashrama Mayavati, Pithoragarh, Himalayas from its Publication Department, Calcutta. (2001)
4. Rosenberg, Marshall Bertram., Nonviolent Communication: A Language of Life., Puddle Dancer Press, Encinitas, CA (2015).
5. Jayanna, Krishnamurthy., Science & Practice of Integrative Health & Wellbeing Lifestyle., White Falcon Publishing (2020).
6. Lipton, Bruce., The Biology of Belief 10th Anniversary Edition: Unleashing the Power of Consciousness, Matter & Miracles, Hay House, Carlsbad (2015).
7. Kalderdon Adizes Ichak., What Matters in Life: Lessons I Learned from Opening My Heart WS Press, Newtown, PA(2023).
8. Murphy, Joseph., The Power of Your Subconscious Mind [Original Edition (Complete)], Prentice-Hall, Englewood Cliffs (1963).
9. Kamlesh D. Patel., Designing Destiny: The Heartfulness Way, Heartfulness Institute, Chennai (2021)

Online Resources (Weblinks)

- Introduction to Psychology
- Guided Meditation
- Life skills and value education
- James Allen Library

Assessment (Practical course)
Participation, Practical activities and assignments, personal wellness plan and reflection.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
			Dr. Ezhilarasi Principal- KCT
Recommended by BoS on	17.08.2024		
Academic Council Approval	No: 27	**Date**	24.08.2024

Semester-3

24HSP005	MASTERING CONVERSATIONS	L	T	P	J	C
		0	0	2	0	1
Course Category: HS		SDG	4 & 8			

Pre-requisite courses - Nil	NIL	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to: (3 to 5)
1	Demonstrate understanding of different perspectives by analyzing complex personal and professional situations.
2	Engage in thoughtful dialogue and discussions about complex, real-world issues, utilizing critical thinking to assess different viewpoints.
3	Apply role-playing as a tool to enhance understanding of workplace dynamics, conflict resolution, and team collaboration.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Empathize with and understand people in both professional and personal contexts, reflecting on situations from multiple perspectives and participating in activities that mirror career-related scenarios	Ap
CO 2	Analyze and converse critically on complex subjects, demonstrating the ability to approach and deal with various social contexts effectively	An
CO 3	Exhibit skills in role-playing and enacting given situations to navigate diverse social interactions and career-related contexts.	C

BTL: R, U, Ap, An, E, C (Remember, Understand, Apply, Analysis, Evaluate, Create)

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1						3			3	2	3		
2									1	2			
3									3	2			

Course Content	
PRACTICAL COMPONENT / ROLEPLAYS DYNAMICS Introduction to Role play - Benefits of role plays - Importance of gesture, tone and modulation-Skill development through role play activities - Types of role plays - Conversation Building through communicative functions-Initiating a dialogue- Framing questions- Receiving feedback	**6 Hours**
PRACTICAL COMPONENT /ROLEPLAYS ON SOCIAL SKILL **Social Interactions:** - (Ordering food at a restaurant- Making a reservation at a hotel-- Shopping at a store-- Attending a party or social gathering) **Travel and Tourism:** (Asking for directions- Booking a flight or hotel-- Exploring a new city- Interacting with local people) **Community and Volunteering:** (Participating in a charity event- Volunteering at a local organization- Discussing community issues- Organizing a community project)	**6 Hours**
PRACTICAL COMPONENT / ROLEPLAYS ON EDUCATION AND TECHNOLOGY **Education and Personal Growth:** (Setting goals-(Short term & Long term)- Creating a study plan- Participating in a workshop- Reflecting on personal growth) **Technology and Online Interactions:** (Participating in an online meeting- Creating a social media post- Writing an email or text message- Making an online purchase) **Technology and Science:** (Explaining a scientific concept- Discussing emerging technologies- participating in Hackathons- Presenting a research paper)	**6 Hours**
PRACTICAL COMPONENT / ROLEPLAYS ON STRATEGIC INSIGHTS **Critical Thinking:** (Evaluating a news article-solving a moral dilemma-Decision with incomplete information-Assessing a historical event) **Problem-Solving:** (Resolving a conflict- Negotiating a deal - Making a complaint-Apologizing for a mistake) **Business and Entrepreneurship:** (Pitching an idea- Negotiating a contract- Conducting a market Research- Presenting a product launch)	**6 Hours**
PRACTICAL COMPONENT / ROLEPLAYS ON CULTURAL EXCHANGE **Cultural Exchange:** (Sharing customs and traditions- Discussing cultural differences- Exploring historical events- Participating in a cultural festival) **Media and Entertainment:** (Event planning- Creating an advertisement-Digital Marketing-Conducting interviews- Creating news broadcast- Writing and Performing a script- Enacting one act plays) **Arts and Culture:** (Visiting an art gallery – Attending / organizing a concert or play - Discussing literature- Creating a piece of art)	**6 Hours**
Theory Hours: **Tutorial Hours:** **Practical Hours:** 30 **Project Hours:** **Total Hours:** 30	

Learning Resources*
Reference books/ Web Links
1. Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. Washington, DC: The George Washington University.

2. Harbour, E., & Connick, J. (2005). Role playing games and activities rules and tips. Retrieved fr https://www.businessballs.com/roleplayinggames.htm
3. Lebaron, J., & Miller, D. (2005). The potential of jigsaw role playing to promote the social construction of knowledge in an online graduate education course. Retrieved from http://paws.wcu.edu/jlebaron/Jigsaw-FnlTCRpdf_050812.pdf
4. Davies, A. (2018). Teaching and learning through role-play: A practical guide. Maidenhead, UK: McGraw-Hill Education.
5. Young, K. C. (2016). The art of role play: Developing realistic scenarios for skill development. Boston, MA: Pearson.
6. Yardley-Matwiejczuk, K. M. (1997). Role play: Theory and practice. London, UK: SAGE Publications Ltd.

Online Resources

1. https://www.niu.edu/citl/resources/guides/instructional-guide
2. https://positivepsychology.com/role-playing-scripts/

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	Quizzes and written assignments, Participation in group activities

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr.Vijayan Ramanathan , Project manager, Toppan Merrill. Technologies, Coimbatore	Dr. Aninditha Sahoo, IIT, Madras Dr.P.R.Sujatha Priyadharshini, Anna University Chennai Dr. E. Justin Ruben, CIT, Coimbatore	Dr. Arokia Lawrence Vijay Dr. Tissaa Tony

Approved by: BoS Chairman	BOS
BoS Approval date:	**16-8-2024**

24MAT231	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS TECHNIQUES (Common to AE, AU, CE, ME, MR)	L	T	P	J	C
		3	1	0	0	4
BS		SDG	7,9			

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	NA

Course Objectives:	The purpose of taking this course is to:
1	**Apply the analytical methods** to solve selected PDEs, including suitable method of characteristics.
2	**Construct Fourier series expansions** for functions defined on a finite interval.
3	Develop the ability to **formulate and solve** the one-dimensional wave equation and steady-state heat equation using **analytical methods**.
4	Introduce students to the **mathematical formulation** of the steady-state two-dimensional heat conduction equation in Cartesian coordinates.
5	Enable students to **compute Fourier transforms** of standard functions and understand their properties.
6	Apply the Z-transform technique to **solve linear difference equations** with constant coefficients.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Solve certain types of partial differential equations.	Ap
CO2	Determine the Fourier Series and half range Fourier Series of a function.	Ap
CO3	Solve one dimensional wave equation, one dimensional heat equation in steady state using Fourier series.	Ap
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	Ap
CO5	Identify Fourier transform, Fourier sine and cosine transform of certain functions and use Parseval's identity to evaluate integrals.	Ap
CO6	Evaluate Z – transform of sequences and inverse Z – transform of functions and solve difference equations.	Ap

	Program Outcomes (PO)(Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2											

	Program Outcomes (PO)(Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
2	3	2											
3	3	2											
4	3	1		2									
5	3	1		2									
6	3	1		2									

Course Content

PARTIAL DIFFERENTIAL EQUATIONS Solution of PDE by direct integration - solution of standard types of first order partial differential equations (excluding reducible to standard types) - Lagrange's linear equation – Linear homogeneous partial differential equations of second order with constant coefficients.	**9 + 3 Hours**
FOURIER SERIES Dirichlet's conditions – Fourier series – Odd and Even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.	**9 + 3 Hours**
BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS Classification of second order quasi linear partial differential equations – Solution of one-dimensional wave equation – Solution of one-dimensional heat equation (excluding insulated ends) – (Cartesian coordinates only).	**5 + 2 Hours**
BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS Steady state solution of two-dimensional heat equation in infinite plate (Insulated edges excluded) – (Cartesian coordinates only)	**4 + 1 Hours**
FOURIER TRANSFORM Statement of Fourier integral theorem – Infinite Fourier transforms – Sine and Cosine Transforms – Properties (Proofs excluded)– Transforms of simple functions – Convolution theorem – Parseval's identity.	**9 + 3 Hours**
Z –TRANSFORM Z-transform - Properties (Proofs excluded) – Convolution theorem- Inverse Z – transform (by using partial fractions, residues and convolution theorem) – Solution of difference equations using Z - transform.	**9 + 3 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**15**	**Practical Hours:**		**Project Hours:**		**Total Hours:**	**60**

Learning Resources

Textbooks

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, edition 2016.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 45th Edition, 2024.

Reference books/ Web Links

1. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 2020 Revised 10th edition.
2. Ian Sneddon., "Elements of partial differential equations", McGraw – Hill, New Delhi, 2022.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 2018.

Online Resources
1. Partial differential equations – https://www.classcentral.com/course/swayam-partial-differential-equations-17721 2. Fourier series – https://www.classcentral.com/subject/fourier-series 3. Fourier Transform - https://www.classcentral.com/subject/fourier-transform

Assessment	
Formative	Summative
Assignments-Open Book Test/Quiz/Case Study Analysis/Group Presentation/Poster Preparation/Mathematical Models, etc.,	MCQ, CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore.	1. Dr. M. Sivakumar Assistant Professor Sr. Grade Vellore Institute of Technology, Vellore 2. Dr. Ramesh Babu Assistant Professor (SG) Amrita University Coimbatore, Tamil Nadu.	1. Ms. S. Sivasakthi 2. Dr. S. Meenapriyadarshini 3. Ms. A. Shanmughavadivu

Recommended by BoS on	25.4.2025		
Academic Council Approval		**Date**	

24AEI201	AERO ENGINEERING THERMODYNAMICS	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	7, 9			

Pre-requisite courses	-	Data Book / Code book (If any)	Stream Table

Course Objectives:	
The purpose of taking this course is to:	
1	Enable the students to perform quantitative analysis of machines and processes involved in energy transformation and the relationship between work and heat.
2	Help students comprehend the laws of thermodynamics and quantify them through relevant measurements.
3	Develop a fundamental understanding of air cycles, gas turbine engines.
4	Understand and apply the thermodynamic behavior of pure substances, including phase changes, property relations, and the use of steam tables and diagrams for property determination.
5	Understand and apply thermodynamic principles through experiments on fuels, engines, refrigeration.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply the basic concepts of thermodynamics to solve problems related to closed and open systems.	Ap
CO 2	Apply the concepts of the second law, entropy, and Carnot principles to solve problems involving engine efficiency and irreversibility.	Ap
CO 3	Analyze the performance characteristics of different air standard cycles.	An
CO 4	Examine the thermodynamic properties of pure substances using steam tables, Mollier diagrams, and phase rules.	An
CO 5	Conduct experiments on various thermodynamics systems	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	3	2	2	2	2	1	2	2	1	2	3	2
2	3	3	2	2	2	2	1	2	2	1	2	3	2
3	3	3	3	1	1	1	1	2	2	1	1	3	2
4	3	3	2	1	1	1	1	2	1	1	1	3	1
5	3	2	2	3	2	2	2	3	3	2	2	3	1

Course Content

FIRST LAW OF THERMODYNAMICS Concept of continuum, macroscopic approach, and thermodynamic systems – Property, state, path and process-quasi-static process - work, Zeroth law of thermodynamics – Concept of temperature and heat, internal energy, specific heat capacities, enthalpy-Introduction to Fuel Properties – Concept of ideal and real gases – First law of thermodynamics and its applications to closed and open systems –Numerical problems.	**8 Hours**
Practical Component: • Determination of viscosity in a given fuel. · • Determination of flash and fire point in a given fuel.	**8 Hours**
SECOND LAW AND ENTROPY Second law of thermodynamics – Kelvin Planck and Clausius statements of second law – Reversibility and irreversibility – Carnot theorem – Carnot cycle, Reversed Carnot cycle– Efficiency & COP – Introduction to Vapour Compression Cycle – Thermodynamic temperature scale – Clausius inequality, concept of entropy, entropy of ideal gas - principle of increase of entropy-Numerical problems.	**7 Hours**
Practical Component: • COP test on a vapour compression refrigeration test rig.	**6 Hours**
AIR STANDARD CYCLES Otto, Diesel, Dual, Air standard efficiency, mean effective pressure -Brayton cycles - Effect of Reheat, Regeneration and Intercooling- Isentropic efficiency of turbine and compressor- Introduction to Stirling cycle. Air standard efficiency – Mean effective pressure- Numerical Problems.	**8 Hours**
Practical Component: • Valve timing and port timing diagrams in IC engines. • Performance test on diesel engine by electrical loading.	**8 Hours**
PROPERTIES OF PURE SUBSTANCES Definition of pure substances – Phase Change of a pure substance- phase rule, p-T diagram for a Pure substance- p-v-T surfaces, thermodynamic properties - ideal and real gases, equations of state, compressibility chart- Determination of dryness fraction– use of Mollier diagram and Steam tables - Numerical Problem.	**7 Hours**
Practical Component: • To study the phase change of a substance from liquid to solid by plotting the cooling curve. (virtual lab) • To determine the melting point of the given substance and to find out the transition time. (virtual lab)	**8 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60

Learning Resources

Textbooks:

1. Cengel, Yunus A., & Boles, Michael A., Thermodynamics: An Engineering Approach., McGraw-Hill, New York (2019).
2. Nag, P. K., Engineering Thermodynamics., McGraw-Hill, New York (2017).

References:

1. Turns, Stephen R., Thermodynamics: Concepts and Applications., Cambridge University Press, Cambridge, United Kingdom (2020).
2. Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. B., Principles of Engineering Thermodynamics, Wiley, India, (2015).
3. D. P. Mishra, Engineering Thermodynamics., Cengage. India, (2011).
4. Çengel, Yunus A., Heat and Mass Transfer: Fundamentals and Applications, McGraw-Hill, New York (2020).
5. Borgnakke, C. and Sonntag, R. E., Fundamentals of Thermodynamics, Wiley, India (2013).
6. Saravanamuttoo, H.I.H., Gas Turbine Theory, Pearson Education, London (2019).

Online Educational Resources:

1. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=709&cnt=4
2. https://www.udemy.com/course/engineering-thermodynamics/
3. https://onlinecourses.nptel.ac.in/noc22_ae17/preview
4. https://www.coursera.org/learn/thermodynamics-intro
5. https://ocw.mit.edu/courses/chemistry/5-60-thermodynamics-kinetics-spring- 2008/index.htm

Assessment (Embedded course)

CAT, Activity and Learning Task (Open-ended questions, reflective journal), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr Lakshmi VM, Scientist/Engineer 'SG', VSSC, ISRO, vm_lakshmi@vssc.gov.in	Dr. S. Periyasamy, Government College of Technology, Coimbatore.	Mr.R. Arul Prakash/AERO

Recommended by BoS on	07/05/2025		
Academic Council Approval	No.	**Date**	

24AEI202	ENGINEERING FLUID MECHANICS AND HYDRAULICS	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	6, 7, 9, 12 & 13			

Pre-requisite courses		Data Book / Code book (If any)	

Course Objectives:	
The purpose of taking this course is to:	
1	**Explain** the basic properties of fluids and the principles of fluid behaviour at rest.
2	**Apply** fundamental equations to solve fluid flow problems.
3	**Use** dimensional analysis and modelling techniques to study fluid systems.
4	**Understand** the working and performance of various hydraulic machines.
5	**Perform** experiments to observe fluid behaviour, verify concepts, and test equipment performance.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Explain the fundamental properties of fluids and the principles of fluid statics.	Understand
CO 2	Solve flow problems using continuity, momentum, and Bernoulli's equations.	Apply
CO 3	Apply dimensional analysis and similitude concepts using Rayleigh's method and Buckingham's π theorem	Apply
CO 4	Analyze boundary layer flow and its effect on drag force.	Analyze
CO 5	Apply principles of hydraulic machines and pumps to determine their performance.	Apply
CO 6	Conduct laboratory experiments to determine flow parameters and performance of fluid machines.	Apply

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	2	1	2	1	2	3	2	2	-	2	3	1
2	3	3	1	2	1	2	3	2	2	-	2	3	2
3	3	3	2	2	2	2	3	2	2	-	2	3	2
4	3	3	2	2	2	2	3	2	2	-	2	3	2
5	3	2	3	2	2	2	3	2	2	1	2	3	2
6	3	3	3	3	3	2	3	3	3	1	3	3	3

Course Content	
FLUID STATICS Introduction to Fluid – Units and Dimensions – Mass density – Specific weight – Specific volume – Specific gravity –Specific heats – Viscosity – Compressibility – Surface tension – Capillarity – Vapour pressure and Cavitation. Pascal's Law and Hydrostatic equation – Forces on plane and curved surfaces – Buoyancy – Metacentre – Simple and differential manometers – Mechanical pressure gauges. **Practical Component:** • Determination of pressure using various manometers • Study of calibration and operation of mechanical pressure gauges	**6 Hours** **6 Hours**
FLUID DYNAMICS Lagrangian vs Eulerian descriptions, Classification of fluid flows -- Flow Visualization – Path line – Streamline – Streak line – Stream and Potential functions – Flownets. Governing equations: Continuity equation – Momentum equation – Energy equation – Euler's equation – Bernoulli's equation – Applications. **Practical Component:** • Verification of Bernoulli's theorem • Determination of the coefficient of discharge of the Venturimeter • Determination of the coefficient of discharge of the Orifice meter • Determination of the coefficient of discharge of Rotometer.	**6 Hours** **6 Hours**
DIMENSIONAL ANALYSIS AND SIMILARITY Rayleigh's method – Buckingham's π theorem – Geometric, Kinematic, and Dynamic similarity – Scale effect – Dimensionless parameters – Mach Number, Reynolds Number, Euler's Number, Weber Number, Froude's Number, and Prandtl Number – Model laws. **Practical Component:** • Determination of Darcy's friction factor. • Determination of Reynolds Number	**4 Hours** **6 Hours**
BOUNDARY LAYER FLOW Boundary layer, Boundary layer thickness: Displacement, Momentum, and Energy thickness. Drag force on a flat plate due to boundary layer –Turbulent boundary layer on a flat plate - Blasius similarity solution and the Momentum Integral Method for a flat plate. Deduction of Governing equations of the boundary layer from Navier-Stokes Equation – Separation of the boundary layer. **Practical Component:** • Measurement of the co-efficient of lift and drag in a wind tunnel to verify model laws. • Flow Visualization and Boundary Layer Separation (Using Smoke or Dye)	**7 Hours** **6 Hours**
HYDRAULIC TURBINES & PUMPS Introduction to hydraulic turbines – Classification – Pelton wheel: working, velocity triangles, efficiency – Francis turbine: working, efficiency – Draft tube – Performance characteristics. Definition and classifications- Centrifugal and Reciprocating Pumps: Working principles- Indicator diagram – Specific speed – efficiency and performance curves - Cavitation in pumps. **Practical Component:** • Performance study of the Pelton and Francis turbine • Performance study of the Centrifugal and Reciprocating	**7 Hours** **6 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60

Learning Resources

Textbooks:

1. Yunus A. Çengel and John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, Fifth Edition (2024 Release), McGraw-Hill Education.
2. Munson, Young, and Okiishi, Fundamentals of Fluid Mechanics,9th Edition, John Wiley & Sons Inc.
3. Frank M. White, Fluid Mechanics, Ninth Edition (2021), McGraw-Hill Education.

References:

1. Pijush K. Kundu, Ira M. Cohen, and David R. Dowling, Fluid Mechanics, Sixth Edition (2015), Academic Press.
2. R.K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Tenth Edition (2018), Laxmi Publications.
3. R. S. Khurmi, A Textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines, Revised Edition (2016), S. Chand & Co.
4. Dr. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, Seventh Edition (2013), S.K. Kataria & Sons.
5. Modi & Seth, Hydraulics and Fluid Mechanics Including Hydraulics Machines, Twenty-First Edition (2017), Standard Book House.

Online Educational Resources:

1. http://nptel.ac.in/courses/101103004
2. https://ocw.mit.edu/courses/16-100-aerodynamics-fall-2005/
3. https://www.coursera.org/learn/fluid-mechanics
4. https://www.edx.org/course/introduction-to-fluid-mechanics
5. https://oli.cmu.edu/courses/engineering-statics-and-dynamics/

Assessment (Embedded course)

CAT, Written Assignments, Presentations, Demonstrations, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests & Viva-voce.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. Kumaresh Selvakumar Research Engineer ExaSlate	Dr. Madhu Ganesh, Professor, Department of Aerospace Engineering, Karunya Institute of Technology and Sciences, Coimbatore.	Dr. M. Senthil Kumar/AERO Mr. Muthukumar S /AERO

Recommended by BoS on	07/05/2025		
Academic Council Approval	No.	**Date**	

24AET203	SOLID MECHANICS	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4,9,11,12			

Pre-requisite courses	Nil	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the principles of stress, strain, and material behavior under different loading conditions.
2	Evaluate shear force and bending moment distribution in beams and apply bending theory to determine stresses.
3	Use analytical methods such as double integration, Macaulay's method, and the moment area method to calculate beam deflections.
4	Analyze torsional stresses in shafts and design helical springs for strength and stiffness.
5	Assess biaxial stress conditions, determine principal stresses, and analyze stress distributions in thin and thick-walled pressure vessels.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain stress, strain, and deformation in solids under axial and thermal loads.	U
CO 2	Analyze beams under various loads and determine shear force, bending moment, and flexural stresses.	An
CO 3	Solve beam deflection and slope using standard analytical methods.	Ap
CO 4	Determine torsional stresses and design shafts and helical springs for strength and stiffness.	Ap
CO 5	Solve the problems on biaxial stress conditions and determine stress distribution in thin and thick pressure vessels.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	1	1	-	-	-	1	-	-	2	3	1
2	3	3	2	1	-	-	2	1	-	-	1	3	1
3	3	3	2	2	-	-	2	1	-	-	1	3	1
4	3	3	2	2	-	-	2	1	-	-	2	3	1
5	3	3	-	1	-	-	-	1	-	-	1	3	1

Course Content	
FUNDAMENTALS OF STRESS AND STRAIN Introduction to Mechanics of Solids, Concept of Stress: Normal and Shear Stress, Strain and Deformation of Solids, Hooke's Law and Generalized Hooke's Law, Poisson's ratio, elastic constants; Analysis of bar of uniform and varying sections, Analysis of composite bars, Thermal Stresses.	**8 Hours**
BENDING OF BEAMS AND SHEAR FORCE Types of Beams and Loads, Shear Force and Bending Moment Diagrams - simply supported beam, cantilever beam & over hanging beams, Theory of Simple Bending, Section Modulus and Flexural Stresses, Shear Stress in Beams.	**10 Hours**
BEAM DEFLECTION Elastic curve of Neutral axis of the beam under normal loads, Evaluation of beam deflection and slope: Double integration method, Macaulay Method and Moment area method.	**9 Hours**
TORSION AND SPRINGS Torsion of Circular Shafts, Power Transmission and Torsional Rigidity, Shear Stress and Angle of Twist in Shafts, Design of Circular Shafts for Strength and Stiffness, Introduction to helical springs, Closed and Open-Coiled Springs.	**9 Hours**
BIAXIAL STRESSES AND THIN & THICK PRESSURE VESSELS Biaxial state of stresses at a point, Stresses on inclined plane, Principal planes and stresses, Mohr's circle for biaxial stresses, Stresses in Thin-Walled Pressure cylindrical vessels, Lame's Theory: Stress Distribution in Thick Cylindrical and Spherical Shells.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Beer, Ferdinand P., Johnston Jr., E. Russell, DeWolf, John T., Mazurek, David F., and Sanghi, Sanjeev Mechanics of Materials, 8th Edition (in SI Units)., Tata McGraw Hill Education (2020).
2. Rattan, S. S. Strength of materials (2nd ed., Vol. 2). McGraw Hill Education (2011).
3. Dowling, N. E., Kampe, S. L., & Kral, M. V. Mechanical behavior of materials (5th ed.). Pearson. (2019).

References:

1. Anand, Lallit. Mechanics of Solid Materials. MIT Department of Mechanical Engineering, Cambridge, MA, USA. Year not specified. MIT MechE
2. Williams, James H., and Socrate, Simona. Lecture Notes on Mechanics & Materials I. MIT Open Course Ware, Massachusetts Institute of Technology, Cambridge, MA, USA, Fall 2006.
3. Reddy, J.N. Energy and Variational Methods in Applied Mechanics, Journal of Applied Mechanics, Vol. 72, No. 3 (2005), pp. 387-397. DOI: 10.1115/1.1894391
4. Christensen, R.M. Stress Analysis of Composite Bars Under Axial Load, Proceedings of the ASME International Mechanical Engineering Congress and Exposition, Paper No. IMECE2004-61432, Anaheim, CA, USA, Nov. 13-19, 2004. DOI: 10.1115/IMECE2004-61432.

Online Educational Resources:

1. MIT OpenCourseWare (meche.mit.edu) – Courses on Mechanics of Solids and Materials Science
2. Purdue University Engineering (engineering.purdue.edu) – Solid Mechanics I Course

3. Cornell Engineering (engineering.cornell.edu) – Solid Mechanics Research & Courses
4. https://cosmolearning.org/courses/mechanics-solids-structural-mechanics/
5. http://nptel.ac.in/courses/112107146/
6. http://www.engineeringcorecourses.com/solidmechanics1/

Assessment (Theory course)
Continuous Assessment Test I & II, Online Quiz, Assignment I & II, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Dr. R. Santhanam, Senior Scientist "F", Defence Research & Development Organisation (DRDO)	Dr. S Venkatachalam Division of Aerospace Engineering Karunya Institute of Technology and Sciences	Mr. Naveen Kumar K, Assistant Professor, Department of Aeronautical Engineering	
Recommended by BoS on	07/05/2025		
Academic Council Approval	No.	**Date**	

24AET204	PRINCIPLES OF FLIGHT	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	9			

Pre-requisite courses		Data Book / Code book (If any)	

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the evolution of flight technology, from early balloon flight to modern aircraft designs, including the Wright Brothers' contributions and advancements in aerodynamics, materials, and propulsion.
2	Identify the different types of flight vehicles, their components, and their functions, focusing on various wing and tail configurations.
3	Explain the fundamental principles of aerodynamics, including the generation of lift, drag, and pitching moments, and their impact on aircraft performance.
4	Explain the different aircraft propulsion systems, their working principles, and evaluate their comparative performance characteristics.
5	Understand the basic concepts of aircraft structures, including various construction types and materials used in aircraft design.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Recall the history of flight, including key milestones in aircraft design and technological advancements.	R
CO 2	Identify and describe the various components of flight vehicles and their functions in the overall operation of an aircraft.	U
CO 3	Explain the basic aerodynamic principles governing lift, drag, and pitching moments, and their effects on aircraft performance.	U
CO 4	Compare different aircraft propulsion systems and their suitability for specific flight requirements.	An
CO 5	Demonstrate an understanding of basic aircraft structures and materials, identifying the advantages and limitations of different construction types.	U

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	1	-	-	-	-	-	-	1	-	-	1	-

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
2	3	2	-	-	1	1	-	-	1	-	1	3	-
3	3	2	-	-	1	1	-	-	1	-	1	3	-
4	3	2	-	-	1	1	-	-	1	-	1	3	-
5	3	2	-	-	1	1	-	-	1	-	1	3	-

Course Content

HISTORY OF FLIGHT Balloon flight, Ornithopter, Heavier-than-air Flight, Wright Brothers' airplane, Evolution of aircraft design, Developments in aerodynamics, materials, structures and propulsion over the years.	**9 Hours**
AIRCRAFT CONFIGURATIONS Atmosphere and its properties - Different types of flight vehicles - classifications- Basic Components of aircraft- principle of operation and their functions - Different types of Wing and Tail configurations - Basic instruments for Flying	**9 Hours**
INTRODUCTION TO AERODYNAMICS Newton's law of motions applied to Aeronautics- Generation of lift, drag and pitching moment, Airfoil lift and drag curve, stall, types of drag, factors affecting lift and drag, Centre of pressure and its significance - aerodynamic center, aspect ratio, Mach number and supersonic flight effects.	**9 Hours**
INTRODUCTION TO AIRCRAFT PROPULSION Aircraft power plants, classification based on the principle of operation. Piston-Propeller Turboprop, Turbojet, Turbofan, Ramjet engines– use of propeller and jets for thrust production- Comparative merits, performance characteristics	**9 Hours**
INTRODUCTION TO AIRCRAFT STRUCTURES General types of construction, Monocoque, semi-monocoque constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials.	**9 Hours**

Theory Hours:45	Tutorial Hours:0	Practical Hours:0	Project Hours:0	Total Hours:45

Learning Resources

Textbooks:

1. Anderson, J.D., "Introduction to Flight", Seventh Edition, McGraw-Hill, 2013.
2. Kermode, A.C. "Mechanics of Flight ", Pearson Education; Eleventh edition, 2006.

References:

1. Federal Aviation Administration "The pilot's handbook of aeronautical knowledge", 2016.

2. Dava Newman “Interactive Aerospace Engineering and Design”, McGraw-Hill, 2002.
3. Richard S. Shevell, "Fundamentals of Flight", Pearson, 2017.
4. David R. Jackson, "Principles of Flight," Butterworth-Heinemann, 2005.
5. R. H. Barnard, "Principles of Flight," Longman, 1991.

Online Educational Resources:

1. https://nptel.ac.in/courses/101106061/
2. https://nptel.ac.in/courses/101106057/
3. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-introduction-to-aeronautical-engineering-spring-2008/
4. https://www.coursera.org/learn/aviation-101
5. https://www.edx.org/course/aerospace-engineering

Assessment (Theory course)
CAT, Activity and Learning Task (One-minute paper, reflective journal, Open-ended questions), MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. Lakshman Anumolu ExaSlate	Dr. K Rajasekar Jain University		Mr.Muthukumar S/AERO Dr.M. Senthil Kumar/AERO
Recommended by BoS on	07/05/2025		
Academic Council Approval	No.	**Date**	

24INM201	Universal Human Values II: Understanding Harmony (Common to All Branches)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	3, 4, 5, 10, 12, 13, 14, 15, 16, 17			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Introduce the concept and significance of value education in shaping a meaningful and fulfilling life.
2	Enable students to understand the human being as a co-existence of self and body and the harmony within.
3	Develop an understanding of harmony in relationships, family, and society.
4	Help students appreciate the interconnectedness and harmony in nature and existence.
5	Instil the importance of ethical behaviour in personal, professional, and social contexts.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the foundational concepts of value education and human aspirations.	U
CO 2	Analyze the human being as a holistic entity comprising self and body.	An
CO 3	Evaluate and cultivate harmonious relationships within the family and society.	E
CO 4	Interpret the interconnectedness in nature and recognize harmony in existence.	U
CO 5	Apply holistic understanding to professional ethics and sustainable living.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	-	-	-	-	-	3	3	3	3	-	3	-	-
2	-	-	-	-	-	3	3	3	3	-	3	-	-
3	-	-	-	-	-	3	3	3	3	-	3	-	-
4	-	-	-	-	-	3	3	3	3	-	3	-	-
5	-	-	-	-	-	3	3	3	3	-	3	-	-

Course Content	
INTRODUCTION TO VALUE EDUCATION Value Education- Self-exploration as the Process for Value Education- Basic Human Aspirations and their Fulfilment - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfil the Basic Human Aspirations.	**3 Hours**
HARMONY IN THE HUMAN BEING Human Being as Co-existence of the Self and the Body- Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programs to Ensure Self-regulation and Health.	**3 Hours**
HARMONY IN THE FAMILY AND SOCIETY Harmony in the Family – The Basic Unit of Human Interaction - 'Trust' – The Foundational Value in Relationship-Respect – As the Right Evaluation - Other Values in Human-to-Human Relationship - Understanding Harmony in the Society Lecture Vision for the Universal Human Order.	**3 Hours**
HARMONY IN THE NATURE (EXISTENCE) Understanding Harmony in Nature- Interconnectedness, Self-regulation and Mutual Fulfilment among the Four Orders of Nature- Realizing Existence as Co-existence at All Levels- The Holistic Perception of Harmony in Existence.	**3 Hours**
IMPLICATIONS OF THE HOLISTIC UNDERSTANDING - A LOOK AT PROFESSIONAL ETHICS Basis for Universal Human Values-Definitiveness of (Ethical) Human Conduct - professional Ethics in the Light of Right Understanding-A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Holistic Technologies, Production Systems-and Management Models - Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	**3 Hours**

Theory	Tutorial	Practical	Project	Total
Hours:15	**Hours:0**	**Hours:0**	**Hours:0**	**Hours:15**

Learning Resources
Textbooks:
1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010. 2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
References:
1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, Jeevan Vidya:Publishers, 1999.
Online Educational Resources:
1. https://www.uhv.org.in/

Assessment (Theory course)
Presentation, MCQ, Assignment, Case Study and E Chart.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
	Sh. Umesh Jadhav, NCCIP (National Co-oridnation Committee)-AICTE	Dr.S.Sivakumar, Associate Professor, SFS Dr.R.Prakasam, Assistant Professor, Department of Physics Mr.J.Sivaguru, Assistant Professor, Department of Mechatronics	
Recommended by BoS on	03/05/2025		
Academic Council Approval	No.	**Date**	26/06/2025

24AEP205	CAD LABORATORY	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4 & 9			

Pre-requisite courses	Engineering Graphics	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Equip students with the skills to create complex 3D models and parts using advanced CAD tools.
2	Create parametric models, where the dimensions and constraints of a design can be easily modified, and changes automatically propagate throughout the model.
3	Manage complex assemblies and co-ordinating between various design components.
4	Develop collaboration skills by working in teams to design, review, and refine products.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Use various modelling tools such as sketcher, part design, surface design, and assembly design to create accurate, functional 3D representations of products.	Ap
CO 2	Apply parametric design techniques in CAD software, allowing them to define and modify models through dimensions and constraints.	Ap
CO 3	Modify designs parametrically, making it easy to update and adapt designs to new requirements or specifications.	An
CO 4	Design, draft and evaluate complex 3D models, parts, and assemblies using CAD software.	E, C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	3	-	-	-	2	-	-	3	-
2	3	-	3	-	3	-	-	2	-	-	-	-	3
3	-	-	3	-	3	-	-	-	3	2	-	3	-
4	-	-	-	-	-	2	-	-	3	2	-	-	3

Course Content	
Ex. 1: Introduction to CAD Modeling and Sketching	
Ex. 2: Part design of Simple Mechanical Components	

Ex. 3: Part design of Upper Housing of a Blower	
Ex. 4: Part design of a Helical Gear	
Ex. 5: Study of Assembly workbench	
Ex. 6: Assembly of Universal Coupling	
Ex. 7: Assembly of Plummer Block	
Ex. 8: Study of Surface Modeling	
Ex. 9: Surface modeling of Airfoil	
Ex. 10: Drafting of Simple Engineering Components	

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**30**	**Project Hours:**	**Total Hours:** **30**

Learning Resources

Textbooks:

1. Sham Tickoo "CATIA V5-6R2019 for Designers" CADCIM Technologies, Pune, India (2019).
2. J. S. Arora "CATIA V5 Surface Design" Pearson Education, New Delhi, India (2012).

References:

1. Michel P. Weiner "CATIA V5 Workbook" McGraw-Hill Education, New York, USA (2006).
2. Ravikumar "CATIA V5 Design and Modeling" Wiley, Hoboken, New Jersey, USA (2016).

Online Educational Resources:

1. https://www.3ds.com/support/training/
2. https://grabcad.com/tutorials
3. https://www.youtube.com/results?search_query=catia+tutorials

Assessment (Practical course)

Lab Workbook, Drawing Exercises, Model Exam, End Semester, and Viva-voce.

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
Mr. G.Verginvino TANCAM	Dr. R. Vishnu Dept. of Mechanical Engg, CIT, Coimbatore	Mr. Arun Kumar R, Aeronautical Engineering, KCT
Recommended by BoS on	07/05/2025	
Academic Council Approval		**Date**

Semester-4

24HSP006	MASTERING GROUP DISCUSSION AND PRESENTATION SKILLS	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4 & 8			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	To equip learners with techniques for organizing and presenting ideas effectively, ensuring logical flow and engaging delivery through appropriate visual and verbal strategies.
2	To enhance students' ability to evaluate diverse viewpoints and articulate reasoned arguments, fostering meaningful participation in collaborative discussions.
3	To strengthen students' ability to adapt their speaking style and content to different audiences and contexts, utilizing digital tools for enhanced presentation effectiveness.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Create and deliver structured presentations with a clear introduction, body, and conclusion, utilizing effective visual tools and appropriate pacing to enhance clarity and impact.	C
CO 2	Analyse issues from multiple perspectives, articulate ideas effectively within group discussions	An
CO 3	Deliver confident presentations and speeches in professional and social settings, leveraging digital tools and technologies to enhance quality and effectiveness.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1		2			1	2		3	3		3		
2		2			1	2		3	3		3		
3		2			1	2		3	3		3		

Course Content

MODULE 1 **Introduction to Group** Discussions - Key skills for effective participation - Phases in a GD - Conversational Phrases in GD.	**6 Hours**

Group Dynamics - Understanding group roles and dynamics - Conflict resolution and management in groups - Techniques for fostering collaboration. **Presentations** - Introduction to Visual Aids and Technology in Presentations. **Delivery Techniques** - Voice modulation and speech clarity - Body language and gestures – audience analysis. **Handling Q&A Sessions** - Preparing for audience questions - Techniques for handling difficult questions - Mock Presentation with Q&A sessions.	
MODULE 2 **Factual Group Discussions**: Focus on sharing and verifying accurate information on a given topic. Participants base their contributions on verifiable data and concrete evidence. **Opinion-based / Argumentative Group Discussion**: Encourages participants to express and defend their point of view on a topic. Evaluate different perspectives and build critical thinking skills.	**6 Hours**
MODULE 3 **Case Study Group Discussion**: Involves analyzing the complexities, identifying key issues, and developing insights or solutions based on the group's collective knowledge. **Abstract Discussion**: Deals with intangible concepts, ideas, or themes without concrete reference points. Encourages creative thinking and theoretical exploration.	**6 Hours**
MODULE 4 **Impromptu Presentations**: Participants speak on a given topic with little to no preparation. Helps develop quick thinking and effective communication skills. **Informative Presentation**: Aims to educate the audience on a specific topic by providing clear, factual information. The focus is on clarity, accuracy, and comprehensiveness. **Demonstrative Presentation**: Interactive sessions where participants engage in hands-on activities to learn practical skills. Often includes exercises, demonstrations, and collaborative tasks.	**6 Hours**
MODULE 5 **Training and Technical Presentation**: Designed to teach specific technical skills or procedures. Includes detailed instructions, demonstrations, and may involve technical jargon. **Academic Presentation**: Involves presenting research findings or theoretical concepts in an academic setting. Emphasizes clarity, evidence-based arguments, and adherence to scholarly standards. **Pitch Presentation:** A concise, persuasive presentation aimed at securing support, investment, or approval. Focuses on the value proposition, potential benefits, and unique selling points. **Persuasive Presentation**: Seeks to convince the audience to adopt a particular viewpoint or take a specific action. Utilizes logical arguments, emotional appeals, and credible evidence. **Multimedia Presentations**: Uses visual and auditory media to convey information and present arguments. Enhances engagement and aids in illustrating complex concepts.	**6 Hours**

Theory Hours:	**-**	**Tutorial Hours:**	**-**	**Practical Hours:**	**2**	**Project Hours:**	**-**	**Total Hours:**	**30**

Learning Resources*

Reference books/ Web Links

1. Powell, M. (2010). Dynamic presentations student's book with audio CDs (2). Cambridge University Press.
2. Reynolds, G. (2011). Presentation Zen: Simple ideas on presentation design and delivery. New Riders.
3. Galanes, G. J., Adams, K., & Brilhart, J. K. (2020). Effective group discussion: Theory and practice (15th ed.). McGraw-Hill Education.
4. Adams, K., & Galanes, G. (2018). Communicating in groups: Applications and skills, a practical guide (18th ed.). McGraw-Hill Education.
5. Ivy, D. K., & Backlund, P. (2018). Speak with confidence: A practical guide. Pearson.
6. Reynolds, G. (2019). Presentation Zen: Simple ideas on presentation design and delivery. New Riders.

Online Resources

1. https://www.coursera.org/learn/verbal-communications-and-presentation-skills
2. https://www.coursera.org/learn/present-with-purpose
3. https://www.coursera.org/learn/teamwork-skills-effective-communication

Assessment

Formative	Summative
-----	1. Participation in group discussions (40%) 2. Individual presentations (40%) 3. Quizzes and written assignments (20%)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies Christ University Bangalore-560029	Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejan – AP III Dr. R Hema – AP II Dr. A S Mythili - AP II

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	**25.04.2025**

24MAI241	NUMERICAL METHODS AND PROBABILITY (Common to AE, AU, CE, ME, MR)	L	T	P	J	C
		3	0	2	0	4
BS		SDG	4, 8, 9			

Pre-requisite courses	-	Data Book / Codes books (If any)	Normal table

Course Objectives:

The purpose of this course is to:

1	Solve algebraic and transcendental equations where analytical solutions are impractical or impossible.
2	Develop the ability to solve engineering problems and other real-world applications using interpolation and integration methods for both data analysis and numerical solutions.
3	Develop problem-solving skills by using these numerical methods to model and solve real-world engineering and scientific problems involving first-order differential equations.
4	Critically analyze the performance of different numerical methods in terms of accuracy, stability, and computational efficiency for solving partial differential equations in practical engineering applications.
5	Apply probability theory to model and solve real-world problems involving uncertainty, risk analysis, and decision-making in engineering, business, and science.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply numerical methods such as Newton–Raphson and Gauss–Jordan techniques to solve algebraic, transcendental, and linear systems of equations arising in engineering applications.	Ap
CO 2	Construct interpolation polynomials and use them for numerical differentiation and integration employing Trapezoidal and Simpson's rules to approximate functions and definite integrals.	Ap
CO 3	Implement numerical techniques including Taylor series, Euler, Improved Euler, Runge–Kutta, and Milne's predictor–corrector methods for solving ordinary differential equations (ODEs).	Ap
CO 4	Solve two-dimensional Laplace's equations using finite difference techniques and visualize potential distributions on rectangular domains relevant to engineering and electrostatics problems.	Ap
CO 5	Analyze and model real-world problems involving uncertainty using fundamental probability concepts.	An
CO 6	Examine the Normal distribution and its properties, and apply it to model and solve engineering and scientific problems involving random variations.	Ap

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)
	1	2	3	4	5	6	7	8	9	10	11	

Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	1	-	-	-	-	-	1	-	-
2	3	3	-	-	2	-	-	-	-	-	1	-	-
3	3	2	-	-	2	-	-	-	-	-	2	-	-
4	3	3	-	-	3	-	-	-	-	-	2	-	-
5	3	3	-	-	3	-	-	-	-	-	2	-	-
6	3	2	-	-	3	-	-	-	-	-	2	-	-

Course Content

NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS Fixed point Iteration method, Newton's method –Solution of linear system by Gauss Jordan method - Iterative method: Gauss Seidel method – Inverse of a matrix by Gauss Jordan method-Jacobi method for finding eigenvalues. **Practical Component** • Gauss Jordan method. • Newton Raphson method.	**9 Hours** **6 Hours**
INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION Newton's forward, backward and divided difference interpolation, Cubic spline interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 and 3/8 rules. **Practical Component** • Newton's divided difference interpolation • Numerical integration by Simpsons rule	**9 Hours** **6 Hours**
NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS Taylor's series method – Euler and Improved Euler methods, fourth order Runge-Kutta method for solving first order equations – Multistep method: Milne's predictor and corrector method, Adams Bashforth method **Practical Component** • Numerical solution of ODE by Euler's method. • Numerical solution of ODE by Milne's method.	**9 Hours** **6 Hours**
SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS Solution of one-dimensional heat equation using Bender Schmidt and Crank Nicholson difference schemes –Solution of one-dimensional wave equation by explicit scheme. Finite difference techniques for the solution of two-dimensional Laplace's equation on rectangular domain. **Practical Component** • Solution of one-dimensional heat equation using Bender Schmidt method.	**9 Hours** **6 Hours**

• Solution of one-dimensional wave equation by explicit scheme	
PROBABILITY AND RANDOM VARIABLES Axioms of probability - Conditional probability – Total probability – Bayes' theorem – Random variable – Distribution function – properties – Probability mass function-Probability density function –Normal distributions – Properties. **Practical Component** • Introduction to R Programming • Normal distribution.	**9 Hours** **6 Hours**

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75

Learning Resources

Textbooks

1. Steven C. Chapra and Raymond P. Canale., Numerical Methods for Engineers with Programming and Software Applications., McGraw-Hill ,7th Edition (2021).
2. Johnson R.A., Miller I and Freund J., Miller and Freund's Probability and Statistics for Engineers., PearsonEducation, Asia 8th Edition (2015).

Reference books

1. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S.R.K.Iyengar and R.K. Jain, New Age International Publishers 2019.
2. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11th extensively revised edition, Sultan Chand & Sons, 2020.
3. Conte S.D and Carl de Boor., Elementary Numerical Analysis - An Algorithmic Approach., McGraw-Hill (2018)
4. John H. Mathews and Kurtis D. Fink., Numerical Methods using Matlab, Prentice Hall of India,4th Edition (2021).

Online Resources (Web Links)

1. https://nptel.ac.in/courses/111106101
2. https//nptel.ac.in/courses/111105041

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
1. Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore.	1. Dr. M. Sivakumar Assistant Professor Sr. Grade Vellore Institute of Technology, Vellore 2. Dr. Ramesh Babu Assistant Professor (SG) Amrita University Coimbatore, Tamil Nadu.	1. Dr. S.Meena Priyadarshini Assistant Professor II Department of Mathematics,KCT 2. Ms.S.Sivasakthi Assistant Professor (SRG) Department of Mathematics, KCT

Recommended by BoS on	28.11.2025		
Academic Council Approval	No: 29	**Date**	24/12/2025

24AEI206	AERODYNAMICS I	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	4, 9 & 13			

Pre-requisite courses	24AEI202	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Apply fundamental aerodynamic equations to calculate flow properties, pressure coefficients, and measure airspeed using experimental techniques.
2	Determine aerodynamic forces and pressure distributions on idealized two-dimensional bodies by applying the principle of potential flow superposition and the Kutta-Joukowski theorem.
3	Analyze the aerodynamic performance of airfoils by applying Thin Airfoil Theory to calculate lift and moment coefficients and identify key aerodynamic reference centers.
4	Evaluate the three-dimensional effects of finite wings by using Prandtl's Lifting Line Theory to predict lift distribution, induced drag, and wing efficiency.
5	Examine propeller performance characteristics and efficiency using froude momentum and blade element theories for fixed and variable pitch propellers.
6	Develop hands-on skills through experimental techniques, including pressure distribution measurement, force analysis on airfoils and wings, and aerodynamic performance evaluation of propellers.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Calculate aerodynamic flow properties and pressure coefficients using the governing fluid dynamic equations	Ap
CO 2	Apply the principle of superposition of elementary potential flows to determine the aerodynamic forces on idealized bodies	Ap
CO 3	Apply Thin Airfoil Theory to calculate the aerodynamic coefficients and characteristic centers of airfoils	Ap
CO 4	Apply Prandtl's Lifting Line Theory to determine the aerodynamic characteristics of finite wings.	Ap
CO 5	Analyze the forces, efficiency, and performance characteristics of propellers using momentum and blade element theories.	An
CO 6	Conduct experimental analysis of aerodynamic characteristics for airfoils, wings, and propellers.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	2	1	2	1	-	-	1	1	-	1	3	1
2	3	3	1	2	1	-	-	1	1	-	1	3	1
3	3	3	2	2	2	-	-	1	1	-	1	3	2
4	3	2	2	2	2	-	-	1	1	-	1	3	2
5	3	2	2	3	2	-	-	1	1	-	1	3	2
6	3	3	2	3	3	-	-	3	3	3	-	3	3

Course Content

INTRODUCTION TO AERODYNAMICS Aerodynamic forces and moments – Pressure distribution on an airfoil – Continuity, momentum equation – Euler's equation – Bernoulli's Equation – Pitot tube: Measurement of airspeed. Pressure Coefficient - Circulation and Vorticity - Streamline, stream function, irrotational flow, potential function, Equipotential lines **Practical Component:** • Measurement of airspeed using a Pitot tube • Verification of Bernoulli's equation	**5 Hours** **4 Hours**
TWO DIMENSIONAL POTENTIAL FLOWS Elementary flows – Uniform, Source, Sink, Doublet and Vortex flow, Combination of a uniform flow with a source and sink, non-lifting flow over a circular cylinder, Lifting flow over a cylinder, Kutta Joukowski theorem and Generation of lift, Flow over a flat plate, D'Alembert Paradox, Magnus effect. **Practical Component:** • Pressure distribution over smooth cylinder • Pressure distribution over rough cylinder	**7 Hours** **6 Hours**
AIRFOIL THEORY Airfoil Nomenclature – Airfoil characteristics – Kelvin's circulation theorem – Thin airfoil theory and its applications – Kutta condition - Aerodynamic Center – Center of pressure. **Practical Component:** • Pressure distribution over symmetrical airfoil • Pressure distribution over cambered airfoil. • Determination of Aerodynamic coefficients of airfoils using computational analysis tools	**7 Hours** **8 Hours**
Wing Theory Vortex filament, bound vortex and trailing vortex, Horse shoe vortex, Biot and Savart law – Downwash and induced drag – Helmholtz theorems, Prandtl's lifting line theory - Applications of Prandtl's lifting line theory.	**7 Hours**

Practical Component: • Force measurement on a wing with symmetircal airfoil • Force measurement on a wing with cambered airfoil • Evaluation of aerodynamic coefficients using XFLR5 (VLM) and MATLAB	**8 Hours**
PROPELLER THEORY Froude momentum and Blade element theories – Propeller coefficients – Performance of fixed and variable pitch propeller – propeller efficiency. **Practical Component:** • Performance analysis of propeller	**4 Hours** **4 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60

Learning Resources

Textbooks:

1. John D. Anderson, **"Fundamentals of Aerodynamics"**, McGraw-Hill Education, United States, 2023.
2. E.L. Houghton, P.W. Carpenter, Steven Collicott, and Daniel Valentine, **"Aerodynamics for Engineering Students"**, Butterworth-Heinemann, United Kingdom, 2021.

References:

1. L.J. Clancy, "Aerodynamics", Pitman Publishing, United Kingdom, 1975.
2. Ethirajan Rathakrishnan, "Theoretical Aerodynamics", Wiley, India, 2021.
3. J.J. Bertin and M.L. Smith, "Aerodynamics for Engineers", Pearson, United States, 2021.
4. A.M. Kuethe and J.D. Schetzer, "Foundations of Aerodynamics: Bases of Aerodynamic Design", Wiley, United States, 1997.
5. Milne-Thomson L.M., "Theoretical Aerodynamics", Dover Publications, United States, 1973.

Online Educational Resources:

1. https://nptel.ac.in/courses/101106042
2. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-16-02-unified-engineering-i-ii-iii-iv-fall-2005/
3. https://www.grc.nasa.gov/www/k-12/airplane/bga.html
4. https://aerospaceweb.org/design/ucav/aerodynamics.shtml
5. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. Lakshman Anumolu ExaSlate	Dr. K Rajasekar Jain University	Mr.Muthukumar S /AERO Dr.M. Senthil Kumar/AERO

Recommended by BoS on	06/12/2025		
Academic Council Approval	No. 29	**Date**	24/12/2025

24AEI207	AIRCRAFT STRUCTURES I	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	4, 9, 11, 12			

Pre-requisite courses	24AET203	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Develop a fundamental understanding of statically determinate and indeterminate structures and their behavior under different loading conditions.
2	Equip students with analytical skills for solving structural problems using energy methods, strain energy principles, and Castigliano's theorem.
3	Introduce the concepts of column stability and buckling analysis using Euler's and Rankine's theories.
4	Provide knowledge of failure criteria and fracture mechanics, including stress intensity factors and fatigue crack propagation.
5	Integrate theoretical concepts with practical applications through hands-on experiments and computational analysis.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze statically determinate structures, including plane and space trusses, using appropriate methods.	An
CO 2	Analyze statically indeterminate structures using advanced techniques such as Clapeyron's Three Moment Equation and the Moment Distribution Method.	An
CO 3	Analyze column stability problems and predict buckling loads using Euler's and Rankine's equations for aerospace structures.	Ap
CO 4	Identify the stability of columns under different loading conditions using Euler's and Rankine's theories.	Ap
CO 5	Understand failure theories and fracture mechanics principles, including stress intensity factors and fatigue analysis.	U
CO 6	Demonstrate the experiments with UTM and determinate beam structures to determinate the predominant parameters.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	2	3	1

2	3	3	2	2	-	-	1	1	-	-	2	2	1
3	3	3	2	2	-	-	1	1	-	-	2	3	1
4	3	3	1	1	-	-	1	1	-	-	2	2	1
5	3	2	1	2	-	-	-	-	-	-	2	3	1
6	3	2	2	1	2	2	2	3	3	1	2	3	1

Course Content

STATICALLY DETERMINATE STRUCTURES Analysis of plane truss – Method of joints, zero-force members, determinacy checks, method of sections, common truss configurations, real-world truss behaviour. 3D (Space) Truss – Coordinate transformation, stability in 3D, force resolution in space frames, applications in aerospace structures	**6 Hours**
Practical Component: • Determination beam support reaction. • Verification of Maxwell's Reciprocal theorem.	**6 Hours**
STATICALLY INDETERMINATE STRUCTURES Clapeyron's Three Moment Equation – Continuous beam analysis, settlement of supports, variable flexural rigidity. Moment Distribution Method – Slope-deflection background, analysis of airframe frames, fuselage bulkhead flexibility.	**6 Hours**
Practical Component: • Determination of Young's Modulus using deflection of Cantilever beam. • Verification of Clapeyron's Three-Moment Equation for a Two-Span Continuous Beam	**6 Hours**
ENERGY METHODS Strain Energy due to axial, bending and torsional loads. Castigliano's theorem for displacements and moments – Deflection analysis of wing spars, rotor blades and truss-type aircraft structures. Unit load method – Virtual work principle, calculation of slopes and deflections, application to beams, trusses and frames.	**6 Hours**
Practical Component: • Verification of Castigliano's theorem in a simply supported beam. • Hardness Test • Charpy Impact tests.	**6 Hours**
COLUMNS Elastic and Inelastic Buckling: Euler's Column theory – Derivation and critical load prediction. Rankine's formula – Combined elastic and inelastic behaviour, empirical constants. Column with initial curvature, Eccentric loading, Beam column.	**6 Hours**
Practical Component: • Validation of Euler's and Rankine's theories for critical buckling load.	**4 Hours**
FAILURE CRITERIA AND FRACTURE MECHANICS Failure Theories: Maximum Stress, Maximum Strain, Maximum Shear Stress, Distortion Energy Theory, Application to ductile and brittle materials, yield surface interpretation. multi-axial stress evaluation in wings, fuselage, and engine pylon structures. Fracture Mechanics: fatigue and crack propagation.	**6 Hours**
Practical Component: • Torsion Test. • Testing failure theories using a universal testing machine (UTM). • Determination of stress-strain behaviour and fracture strength of steel using UTM.	**8 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 60

Learning Resources

Textbooks:

1. Timoshenko, S. P., & Gere, J. M. Theory of Elastic Stability. McGraw-Hill Education (2017).
2. Srinath, L. N. Advanced Mechanics of Solids. Tata McGraw-Hill Education, 3rd Edition (2008).
3. Gere, J. M., & Goodno, B. J. Mechanics of Materials (9th ed.). Cengage Learning (2020).
4. Hibbeler, R. C. Structural Analysis (11th ed.). Pearson (2022).

References:

1. Megson, T. H. G. Aircraft Structures for Engineering Students (6th ed.). Butterworth-Heinemann (2019).
2. Hertzberg, Richard W., Vinci, Richard P., and Hertzberg, Jason L. Deformation and Fracture Mechanics of Engineering Materials, Wiley, New York, NY (2012).
3. Bazant, Zdeněk P., and Cedolin, Luigi. "Stability of Structures: Elastic, Inelastic, Fracture, and Damage Theories." Journal of Engineering Mechanics, Vol. 121 No. 12 (1995): pp. 1393-1402, DOI: 10.1061/(ASCE)0733-9399.
4. Zingoni, Alphose. "Advances in the Stability Analysis of Statically Indeterminate Structures." Proceedings of the 5th International Conference on Structural Engineering, Paper #102, Cape Town, South Africa, March 10-12, 2015.
5. Bruhn, Ernest. "Analysis and Design of Flight Vehicle Structures." Technical Report No. 23-567, Purdue University, Indiana, USA (1973).

Online Educational Resources:

1. https://ocw.mit.edu/courses/2-080j-structural-mechanics-fall-2013/
2. https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-elements-of-structures
3. http://nptel.ac.in/courses/112106141/
4. https://www.edx.org/course/introduction-to-aerospace-structures-and-materials
5. https://cosmolearning.org/courses/introduction-aerospace-structures/

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. R. Santhanam, Senior Scientist "F", Defence Research & Development Organisation (DRDO)	Dr. S Venkatachalam Division of Aerospace Engineering Karunya Institute of Technology and Sciences	Mr. Naveen Kumar K, Assistant Professor, Department of Aeronautical Engineering

Recommended by BoS on	06/12/2025		
Academic Council Approval	No. 29	**Date**	24/12/2025

24AEI208	AIRCRAFT PROPULSION	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	7 & 9			

Pre-requisite courses	24AEI201	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Explain the fundamentals, performance parameters, and modern advancements in piston engines and gas turbine engines.
2	Describe inlet, fan, and nozzle aerodynamic behaviour and their influence on engine operability and thrust generation.
3	Interpret the operating principles, energy transfer mechanisms, and stability considerations of axial and centrifugal compressors.
4	Discuss combustion processes, emission formation, and sustainable propulsion technologies including hydrogen combustion and SAF.
5	Explain turbine aerothermodynamics, cooling techniques, and emerging future propulsion concepts for next-generation aircraft.
6	Perform experiments to interpret thrust, flow, combustion, and heat-transfer characteristics relevant to air-breathing propulsion systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Summarize the working principles, thrust equation, and performance parameters of piston and gas turbine engines including UHBR and GTF technologies.	Un
CO 2	Analyze inlet, and nozzle aerodynamic behaviour, losses, pressure recovery, and thrust production.	An
CO 3	Explain energy transfer, stage loading, degree of reaction, and stability limits of axial and centrifugal compressors.	Ap
CO 4	Interpret combustion processes, emission formation, low-emission combustor technologies, hydrogen combustion and SAF-based sustainable propulsion.	Ap
CO 5	Analyze turbine aerodynamics, blade cooling techniques, and emerging hybrid-electric, open-rotor, and fuel-cell propulsion systems.	An
CO 6	Evaluate the performance and thermal behaviour of air-breathing propulsion components through experimental analysis.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	2	1	1	1	-	-	-	-	-	2	3	2
2	3	3	2	2	3	-	-	1	-	-	2	3	2
3	3	2	2	1	2	-	-	-	-	-	2	3	2
4	2	2	1	-	1	3	-	-	-	-	3	2	2
5	3	2	2	1	2	-	-	1	-	-	3	3	2
6	3	3	2	3	3	-	-	3	2	2	3	3	3

Course Content

AIR-BREATHING PROPULSION FUNDAMENTALS Overview of piston and gas turbine engines-working principles and engine component functions. Thrust equation and factors influencing thrust -Key performance parameters including SFC and efficiencies. Comparison of turbojet, turbofan, turboprop, and turboshaft engines - Introduction to modern ultra-high bypass ratio (UHBR) and geared turbofan (GTF) technologies.	**6 Hours**
Practical Component: • Measurement of Thrust and Efficiency of a Propeller • Component Study and Operating Cycle of a Reciprocating (Piston) Engine	**6 Hours**
INLET AND NOZZLE Subsonic and supersonic inlet - ram recovery characteristics - Inlet losses and starting issues. Nozzle types including convergent and convergent–divergent nozzles - nozzle performance parameters, and variable-area nozzles. Fundamentals of thrust reversal and intake/exhaust design considerations in modern aircraft engines, Introduction to noise reduction and control methods.	**5 Hours**
Practical Component: • Determination of Pressure Recovery in a Two-Dimensional Diffuser • Study of Thrust Characteristics of a Nozzle • Analysis of Velocity Profiles in Free Jet and Wall Jet Flows	**6 Hours**
COMPRESSOR AERODYNAMICS AND PERFORMANCE Principles of centrifugal and axial compressors, Euler's turbomachinery equation, and energy transfer. Velocity triangles, stage loading, and degree of reaction. Compressor characteristics including stall, surge, and methods to improve stall margin using variable IGVs and bleed systems. Introduction to transonic compressor technology.	**6 Hours**
Practical Component: • Study of Major Components and Flow Path of a Jet Engine	**6 Hours**

COMBUSTION AND SUSTAINABLE PROPULSION Types of aircraft combustors and their operating processes- flame stabilization and combustor cooling techniques. Formation of emissions (NOx, CO, UHC) and basic ICAO emission standards. Overview of low-emission combustor technologies -lean burn and RQL (Rich-burn, Quick-mix, Lean-burn) designs. Introduction to sustainable propulsion concepts - hydrogen combustion fundamentals - compatibility with Sustainable Aviation Fuels (SAF). **Practical Component:** • Measurement of flame speed using different air fuel ratios • Demonstration of the combustion process in Ramjet Engine	**6 Hours** **6 Hours**
TURBINES AND FUTURE PROPULSION SYSTEMS Axial turbine stage fundamental - velocity triangle- turbine work output, and stage efficiency. Introduction to heat transfer - Basics of turbine blade cooling techniques - internal cooling and film cooling. Turbine compressor matching and operability considerations. Introduction to next-generation propulsion systems. **Practical Component:** • Demonstration of free and forced convection	**7 Hours** **6 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours**	**30**	**Project Hours:**	**0**	**Total Hours:**	**60**

Learning Resources

Textbooks:

1. Philip Hill and Carl Peterson, 'Mechanics and Thermodynamics of Propulsion', Pearson Education, United Kingdom, 2009.
2. Saravanamuttoo, H.I.H., Paul Straznicky, Henry Cohen, and Gordon Rogers, 'Gas Turbine Theory', United Kingdom, Pearson Education, 2019.

References:

1. Ganesan. V., 'Gas Turbines', McGraw-Hill Education, McGraw Hill Education, New York City,2017.
2. Jack D. Mattingly, 'Elements of Propulsion: Gas Turbines and Rockets', American Institute of Aeronautics & Astronautics, United States, 2017.
3. Saeed Farokhi, 'Aircraft Propulsion', Wiley, India, 2014.
4. Ahmed F. El-Sayed, 'Aircraft Propulsion and Gas Turbine Engines', CRC Press, India,2017.
5. C. Jaganathan and S.K Jain, "Jet Engines", Yes Dee,India, 2016.

Online Educational Resources:

1. https://nptel.ac.in/courses/101101002/
2. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-50-introductionto-propulsion-systems-spring-2012/
3. https://www.grc.nasa.gov/www/k-12/UEET/StudentSite/engines.html.
4. https://www.rolls-royce.com/products-and-services/civil-aerospace.aspx.
5. https://www.geaviation.com/commercial/engines

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr.Thiyagarajan K Manager, Engine Manufacturing sector, Tata Advance System, Hyderabad.	Dr. A.P. Haran, Professor & Dean of Mechanical Sciences, PARK College of Engineering & Technology, Coimbatore.		Mr.R.Arul Prakash/AERO Dr.M. Senthil Kumar/AERO
Recommended by BoS on	06/12/2025		
Academic Council Approval	No. 29	**Date**	24/12/2025

24AET209	AIRCRAFT MECHANISMS AND MACHINE DYNAMICS	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4, 9 & 12			

Pre-requisite courses	Engineering Mechanics	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the kinematic structure and analysis of mechanisms used in machines, engines, and flight systems.
2	Recognize different cam types and follower motions and to develop cam profiles for specified motion transmission.
3	Solve problems related to friction in machine elements relevant to aerospace applications.
4	Apply the law of gearing and gear train principles to compute velocity ratios and study interference in gears.
5	Describe and apply balancing techniques for rotating and reciprocating masses, critical in aero-engines and propellers.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify types of mechanisms and differentiate the motion of four-bar linkages, slider-crank, and other inversions for aerospace applications.	An
CO 2	Classify cam types and follower motions, and construct cam profiles (SHM, cycloidal, uniform velocity) for motion transmission.	An
CO 3	Apply principles of friction in machine elements and determine forces in clutches, brakes, and bearings used in aerospace systems.	Ap
CO 4	Apply gear terminology and the law of gearing to analyse gear trains and calculate velocity ratios.	An
CO 5	Interpret principles of static and dynamic balancing and predict reciprocating mass balancing and gyroscopic effects in rotating components.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1 Engineering Knowledge	2 Problem Analysis	3 Design/Development of Solutions	4 Conduct Investigations of Complex Problems	5 Engineering Tool Usage	6 The Engineer and The World	7 Ethics	8 Individual and Collaborative Team work	9 Communication	10 Project Management and Finance	11 Life-Long Learning	PSO-1	PSO-2
1	3	3	2	2	3	2	-	3	3	-	2	3	2
2	3	3	3	2	2	-	-	3	3	-	2	3	2
3	3	2	2	2	2	2	2	3	3	-	2	3	2
4	3	3	3	2	2	2	2	3	3	-	2	3	3
5	3	3	2	3	2	3	3	3	3	-	2	3	3

Course Content	
MECHANISMS Introduction to Mechanisms: Definitions: link, pair, chain, kinematic structure -Types of pairs (lower and higher pairs) -Types of motion: translation, rotation, oscillation - Gruebler's criterion (mobility) - Constrained motion, degrees of freedom. Basic Mechanisms: Four-bar linkage - Grashof conditions - Slider-crank mechanism and its inversions. Kinematic Analysis: Graphical methods (velocity and acceleration polygons) - Relative velocity method- Instantaneous centres (centroid method) - Klein's construction - Coriolis acceleration component.	**12 Hours**
CAMS & FOLLOWERS Cams and Followers: Types of cams (disc, cylindrical, translating) and followers (roller, knife-edge, flat). Displacement (motion) curves: uniform velocity, simple harmonic motion (SHM), uniform acceleration and deceleration and cycloidal motion. Layout and construction of cam profiles - Pressure angle, undercutting, and design issues – Cam & Follower assemblies for precise actuation of aircraft controls - valve actuators in IC Engines.	**8 Hours**
FRICTION Fundamentals of Friction: Static vs kinetic friction, rolling friction - Laws of dry friction -Viscous (fluid) friction. Surface Contacts & Lubrication: Screw and nut friction (self-locking, efficiency) - Pivot and collar friction - Types of Thrust Bearings Used in Aircraft. Friction Devices: Clutches and Brakes: Friction in Power Transmission Devices: Belt drives (flat belt, V-belt).	**10 Hours**
GEARS AND GEAR TRAINS Gears: Law of gearing (involute profile) - Gear terminology (pitch circle, base circle, addendum, dedendum, tooth thickness, etc.) Interference and undercutting; minimum number of teeth. Types of Gears: spur, helical, bevel, worm & worm wheel, rack & pinion - Gear materials. Gear Trains: Types: simple, compound, reverted, epicyclic (planetary) - Velocity ratio calculation: analytical and tabular methods.	**7 Hours**
BALANCING Static and Dynamic Balancing: Concept of balancing, reason for unbalance - Static balancing of rotating masses - Dynamic balancing (single and multiple plane). Introduction to Vibration - Definition of vibration, Free and forced vibration - Relation between imbalance and vibration. Reciprocating Mass Balancing: Primary and secondary balancing in reciprocating engines Gyroscopic Effects: Principle of gyroscopic couple - Effect of gyroscopic moments in aircraft (during turning, pitching) - Gyroscopic effects in propellers, rotors - Implications for stability and control.	**8 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Shigley, Joseph E., Uicker, John J., and Pennock, Gordon R., Theory of Machines and Mechanisms, Oxford University Press, New York (2017).
2. Norton, R.L., Design of Machinery, 6th Edition, McGraw-Hill, 2020
3. Ratan, S. S., Theory of Machines, Tata McGraw-Hill, New Delhi (2019).

References:

1. Uicker, John J., Pennock, Gordon R., and Shigley, Joseph E., Theory of Machines and Mechanisms, Oxford University Press, New York (2017).
2. Riley, William F., and Sturges, Leroy D., Engineering Mechanics: Dynamics (often used for Mechanics of Machines topics), McGraw-Hill, New York (2002).
3. Sclater, Neil, Mechanisms & Mechanical Devices Sourcebook, McGraw-Hill, New York (2020).

Online Educational Resources:

1. Kinematics of Mechanisms and Machines: https://nptel.ac.in/courses/112105268
2. Kinematics of Machines: https://nptel.ac.in/courses/112104121
3. Dynamics of Machines: https://www.youtube.com/playlist?list=PL46AAEDA6ABAFCA78
4. Mechanisms: https://ocw.metu.edu.tr/mod/resource/view.php?id=2094&forceview=1

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr. H. Karunakaran Supervisor – Planning Flowserve, Coimbatore	Dr.R.Vishnu Dept. of Mechanical Engg., CIT, Coimbatore	Mr R. Arun Kumar, KCT

Recommended by BoS on	06/12/2025		
Academic Council Approval	No. 29	**Date**	24/12/2025

24AET210	AIRCRAFT SYSTEMS AND INSTRUMENTS	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	7 & 9			

Pre-requisite courses	24AET204	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Provide an understanding of the fundamental aircraft systems and their integration in flight operations.
2	Introduce students to different types of aircraft powerplants and their operational principles.
3	Understand the classification of flight instruments and their role in navigation and control.
4	Familiarize students with modern aircraft safety measures through simulation and case studies.
5	Analyse human factors affecting cockpit design and pilot workload management.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the working principles of various aircraft systems, including flight control, hydraulic, and electrical systems.	U
CO 2	Interpret and analyze data from flight instruments, including pitot-static systems, gyroscopic instruments, and electronic flight displays.	An
CO 3	Demonstrate knowledge of modern avionics, navigation aids and aircraft communication systems used in flight operations.	Ap
CO 4	Understand the role of Flight Data Recorders (FDR), Cockpit Voice Recorders (CVR), and emergency systems in enhancing aircraft safety and accident investigation.	U
CO 5	Describe the inspection procedure and troubleshooting on aircraft.	R

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	2	2	1	3	1	2	3	2	2	3	1
2	3	2	1	2	1	3	1	2	2	2	2	3	1
3	3	2	2	2	1	3	2	2	2	2	2	3	1
4	3	2	1	2	1	3	2	2	2	2	2	3	1
5	3	2	2	2	1	3	1	2	2	2	2	3	1

Course Content	
AIRCRAFT SYSTEMS AND FLIGHT CONTROL TECHNOLOGIES Overview of Aircraft Systems and Subsystems, Classification of Flight Systems, Fluid Power Systems in Aircraft, Electrical Power generation and distribution system, Aircraft Ice Protection and Prevention Systems, Advanced Flight control systems – FBW-Autopilot, Morphing wings.	**9 Hours**
AIRCRAFT ENGINE SYSTEMS AND PERFORMANCE Overview of Aircraft Powerplants, Types of Aircraft Engines, Fuel Management and Distribution Systems in Piston and Jet engine, Engine Lubrication Systems, FADEC Architecture and Operation, Aircraft Engine Health Monitoring	**9 Hours**
AIRCRAFT INSTRUMENTATION FUNDAMENTALS Classification of Flight Instruments, Pitot-Static System and Related Instruments (Airspeed Indicator, Altimeter, VSI), Gyroscopic Instruments (Attitude Indicator, Heading Indicator, Turn Coordinator), Electronic Flight Instrumentation System (EFIS), Navigation Aids, Aircraft Communication Systems.	**9 Hours**
SAFETY AND DATA RECORDING SYSTEMS Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR), Aircraft Health Monitoring Systems (AHMS), Fire Detection and Suppression, Failure Warning and Safety Systems, AI-Based Fault Detection, Digital Twin Technology, Big Data in Aviation Safety.	**9 Hours**
COCKPIT LAYOUT AND HUMAN-MACHINE INTERFACE Human Factors Engineering, Cockpit Layout and Ergonomics, Display Systems, Flight Management System (FMS), Glass Cockpit Technology and Adaptive display system, Voice-Controlled Systems, Augmented Reality (AR) and Virtual Reality (VR) in Cockpit Displays.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:**	**45**

Learning Resources

Textbooks:

1. E. H. J. Pallett, 'Aircraft Instruments – Principles and Applications', Second Edition, Longman House, 1981.
2. E. H. J. Pallett and S. Coyle, 'Automatic Flight Control', Fourth Edition, Blackwell Science Ltd, 1993.
3. Irwin Treager, 'Aircraft Gas Turbine Engine Technology', Third Edition, McGraw Hill, 1997.
4. James Powell, 'Aircraft Radio Systems', Shroff Publishers, 2006.
5. Ian Moir and Allan Seabridge, 'Aircraft Systems – Mechanical, electrical and avionics subsystems integration', Second Edition, Professional Engineering Publishing Limited, 2001.
6. Ian Moir, Allan Seabridge and Malcolm Jukes, 'Civil Avionics Systems', Second Edition, Wiley, 2013.
7. 'General Hand Book of Airframe and Powerplant Mechanics', U.S. Dept. of Transportation, Federal Aviation Administration, English Book Store, New Delhi, 1995.

References:

1. https://www.princeton.edu/~stengel/MAE331Lecture10.pdf
2. http://okigihan.blogspot.com/2017/04/aircraft-hydraulic-system.html
3. http://okigihan.blogspot.com/2017/06/aircraft-pneumatic-systems.html
4. home.iitk.ac.in/~mohite/Basic_construction.pdf
5. https://science.ksc.nasa.gov
6. Pilot's Handbook of Aeronautical Knowledge: https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/

7. MIT Open Courseware lectures notes on Aircraft Systems Engineering: https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2004/lecture-notes/
8. NPTEL Online course materials on Aircraft Maintenance: https://nptel.ac.in/courses/101104071/

Online Educational Resources:

1. https://ocw.mit.edu/courses/aeronautics-and-astronautics/
2. https://www.coursera.org/
3. https://www.edx.org/course/introduction-to-aeronautical-engineering
4. https://www.humanfactors.com
5. https://www.nasa.gov
6. https://www.eurocontrol.int
7. https://www.ergonomics.org.uk
8. https://www.skybrary.aero
9. https://www.ntsb.gov
10. https://www.icao.int
11. https://aviation-safety.net

OPEN COURSEWARE & FREE STUDY MATERIAL

- MIT OpenCourseWare (Flight Controls): https://ocw.mit.edu
- NASA Technical Reports Server: https://ntrs.nasa.gov
- FAA Handbooks: https://www.faa.gov
- EASA Publications: https://www.easa.europa.eu

Assessment (Embedded course)
SA I and SA II, Activity and Learning Task(s), Mini project, MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Thaariq Ahmad Rafiq, Next Leap Aeronautics Private Limited, Bangalore	Daniel Davison, University of Waterloo **ddavison@uwaterloo.ca** (519) 888-4567 ext. 35338	Dr J Darshan Kumar Dr S Senthil Kumar	
Recommended by BoS on	06/12/2025		
Academic Council Approval	No. 29	**Date**	24/12/2025

24INM102	INDIAN KNOWLEDGE SYSTEMS IN SCIENCE AND ENGINEERING (Common to All branches)	L	T	P	J	C
		1	0	0	0	1
HS		SDG	5, 16			

Pre-requisite courses	-	Data Book / Codes / Standards (If any)	-

Course Objectives:	The purpose of taking this course is to:
1	Explore the Role of Traditional Knowledge in Basic Scientific Concepts.
2	Know the science behind the establishment of traditional architecture.
3	Revive ancient Indian aerospace, metallurgy and navigation technologies.
4	Revitalize ancient textile traditions through sustainable practices, promoting eco- friendly materials.
5	Explore and integrate ancient Indian medical systems like Ayurveda, Siddha & Rasa Shastra

Course Outcomes	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Understand Indigenous Knowledge Systems (IKS) in Science and Technology	U
CO 2	Apply Traditional Design Principles in Civil Engineering	Ap
CO 3	Explore Ancient Aerospace Technologies for Aeronautical Engineering	E
CO 4	Know the sustainable traditional textile practices for eco-friendly atmosphere	R
CO 5	Gain knowledge of Ancient Medical Practices for Biotechnologists	U

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2	2	2	2	1	2	3	1	2	1	3		
2	2	2	2	2	1	2	2	1	2	1	3		
3	2	2	2	2	1	2	2	1	2	1	3		
4	2	2	2	2	1	2	2	1	2	1	3		
5	2	2	2	2	1	2	2	1	2	1	3		

COURSE CONTENT

IKS IN BASIC SCIENCES Study of ancient Indian concepts such as atomism (paramāṇu)- the five elements (Panchabhūta)- Exploration of alchemical practices, metallurgy-development of zero, decimal systems, algebra, and trigonometry - works by scholars such as Brahmagupta and Aryabhata - Detailing planetary motions and timekeeping systems.	**3 hours**
IKS IN CIVIL ENGINEERING Evolution from rock-cut caves to grand temples like Madurai Meenakshi and Brihadeeswarar - Vastu Shastra- The Concept of "Mandala- Courtyard Design- Sacred	**3 hours**

Geometry- Panchabhuta - Chhatri- dome-shaped canopy- Prana Vayu- Shilpa Shastra- Sthapatya Veda- Kaalchakra-Brahmasthan.	
IKS IN MECHANICAL ENGINEERING Exploration of ancient metallurgical techniques-including ore extraction-alloying, furnace design-Vimana (Flying Machines) - Shakti (Energy Source) -Aerospace materials- Vimana Shapes -Ancient Navigation- Vedic Astronomy- Flight Principles in Nature- Matrika Systems-Indian shipbuilding techniques and navigation methods.	**3 hours**
IKS IN TEXTILE TECHNOLOGY Introduction to Ancient Indian Textiles- Cultural and Historical Context -Traditional Dyeing Techniques-Weaving Techniques and Patterns-Khadi - Natural Fibres and Materials- Cotton, Silk, Wool and Jute-Sustainable Practices and Eco-Friendly Technologies-Organic Cotton Farming-Recycling and Repurposing.	**3 hours**
IKS IN MEDICINE Ayurveda- Siddha Medicine- Rasa Shastra- Herbal Medicine- Nadi Pariksha- Chikitsa- Yoga and Pranayama- Surgical Techniques - Charaka Samhita - Sushruta Samhita—Panchagavya usage-Medicinal Plants and Herbal Remedies-Agricultural Practices and Crop Diversity-Sacred and Ritual Plants.	**3 hours**

Theory Hours: 15	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:15**

Learning Resources

Textbooks

1. Indian Knowledge Systems: A Sustainable Approach: The Science of Self-Healing" by Vasant Lad, Excel India Publisher, 2024.
2. Indigenous Knowledge Systems: Towards a Holistic Inclusive Conservation, Satarupa Dutta Majumder, Manohar Publishers & Distributors, 2019.

References

1. Indian Knowledge System: Integrating Heritage with Engineering, Gagan Bansal, Deep Science Publishing, 2025

Online Resources

www.deepscienceresearch.com/dsr/catalog/book/70

Assessment (Theory Course)

Presentation, MCQ, Assignment, Case Study and E Chart.

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
-	Dr K Sangeetha, Professor and Head-Textile Department, IKS-Nodal officer, Bharathiyar University, Coimbatore-46.	Dr.R.Prakasam, Assistant Professor, Department of Physics. Capt-A.R.Arul, Assistant Professor, Department of Physics

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	**25-04-2025**

Semester-5

24HSP007	Building Professional Readiness	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4 & 8			

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	

Course Objectives:	The purpose of taking this course is to:
1	To familiarize students with various interview formats and equip them with essential techniques for effectively handling personal, behavioural, stress, and panel interviews.
2	To develop self-awareness and career readiness by guiding students in analysing job roles, articulating career goals, and confidently presenting their skills and experiences.
3	To enhance students' adaptability in diverse career pathways by exploring alternative job opportunities, entrepreneurial ventures, and global career options beyond traditional engineering roles.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	**Effectively navigate various interview formats** by applying appropriate techniques for personal, behavioural, stress, and panel interviews, demonstrating confidence and professionalism in different interview scenarios.	Ap
CO 2	**Exhibit career readiness and self-awareness** by analysing job roles, articulating career aspirations, and presenting skills and experiences in alignment with employer expectations.	An
CO 3	**Evaluate and explore diverse career pathways** beyond traditional engineering roles, demonstrating adaptability in pursuing opportunities in entrepreneurship, global careers, public sector roles, and other emerging industries.	E

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
Course Outcomes (CO)	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	-	-	-	-	-	2	2	3	3	-	3	-	-
2	-	-	-	-	-	2	2	3	3	-	3	-	-
3	-	-	-	-	-	2	2	3	3	-	3	-	-

Course Content

Career Awareness and Goal Setting
• Exploring Varied Career Options Beyond Engineering
  • Industry Roles
  • Startups and Entrepreneurial Ventures
  • Research Opportunities and Higher Education
  • Public Sector and Non-Profit Careers
• Self-Assessment and Personal Reflection
• Identifying Strengths, Weaknesses, Skills, and Career Aspirations
• Setting Short-Term and Long-Term Career Goals
	6 Hours

Fundamentals of Interview Preparation • Analysing Company Background and Understanding Job Roles • Aligning Career Goals with Job Opportunities • Professional Etiquette and Appearance • Interview Dress Code, Grooming, and First Impression • Resume and Digital Profile Readiness • Types of interviews: personal, behavioural, stress, virtual, and panel	**6 Hours**
Behavioural Interviews – Responding with Purpose • Introduction to behavioural interviews: What and Why? • Common behavioural interview questions • The STAR technique (Situation – Task – Action – Result) • Identifying and reflecting on past experiences • Mapping soft skills to behavioural questions • Practicing concise storytelling • Active listening and adapting responses	**6 Hours**
Stress Interviews – Performing Under Challenging Situations • Understanding stress interviews: Purpose and setting • Types of stress tactics (rapid-fire questions, silence, disagreement, interruptions) • Strategies to stay composed and confident • Emotional regulation and response control • Maintaining clarity, tone, and respect under pressure • Practicing assertive and professional body language • Turning pressure moments into strengths	**6 Hours**
Panel Interviews • What is a panel interview? Structure and expectations • Understanding panel roles (HR, technical, managerial) • Techniques for engaging with a diverse panel • Managing eye contact, addressing questions, and body posture • Preparing multi-perspective answers • Handling follow-up or cross-questions • Strategies for closing the interview with impact	**6 Hours**

Theory Hours:	**-**	**Tutorial Hours:**	**-**	**Practical Hours:**	**2**	**Project Hours:**	**-**	**Total Hours:**	**30**

Learning Resources*

Reference books/ Web Links

1. Amos, J. (2004). Handling Tough Job Interviews: Be Prepared, Perform Well, Get the Job. United Kingdom: How To Books.
2. Clark, A. (2019). Cracking the Behavioral Interview Code!!! How to Answer Behavioral Interview Questions and Answer with a Preparation Guide + 20 Most Popular Behavioral Interview Questions and Answers.. (n.p.): Amazon Digital Services LLC - KDP Print US.
3. Collins, A. (2015). HR Interview Secrets: How to Ace Your Next Human Resources Interview, Dazzle Your Interviewers and LAND the JOB YOU WANT!. United States: Success in HR Publishing.
4. Downes, C. (2008). Cambridge English for Job-hunting Student's Book with Audio CDs (2). Germany: Cambridge University Press.
5. Hatcher, S. (2015). Group Interview Preparation: Learn How to Use Group Discussion to Your Advantage and Be Comfortable, Confident, and Likeable While Standing Out in a Group Interview. (n.p.): CreateSpace Independent Publishing Platform.
6. McKay, D. R. (2013). The Everything Job Interview Question Book: The Best Answers to the Toughest Interview Questions. United States: Adams Media.
7. Ryan, R. (2016). 60 Seconds and You're Hired!: Revised Edition. United States: Penguin Publishing Group.
8. Winter, S. (2020). Job Interview Preparation and Conversation Skills 2-in-1 Book: Learn How to Crush Your Next Job Interview and Develop A Magnetic Charisma to Enhance Your Communication Skills. United States: Native Publish

Online Resources

1. https://www.coursera.org/projects/preparation-for-job-interviews
2. https://www.coursera.org/projects/accomplishment-star-techniques-for-job-interviews
3. https://www.coursera.org/specializations/english-interview-resume

Assessment	
Formative	Summative
-----	4. Participation in Mock interviews (80%) 5. Career Readiness Portfolio Submission (20%)

Course Curated By

Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
Mr. Bhuvana Sundar Soorappaiah Program Manager Bosch, Coimbatore	Dr Kishore Selva Babu Head and Associate Professor Department of English and Cultural Studies Christ University Bangalore-560029	Dr. J Srikala- AP III Dr. C Tissaa Tony - AP III Dr. S G Mohanraj – AP III Dr. S Sreejan – AP III Dr. R Hema – AP II Dr. A S Mythili - AP II

Approved by: BoS Chairman	With Signature and date
BoS Approval date:	**25.04.2025**

24AET301	Aerodynamics II	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	9 & 13			

Pre-requisite courses	24AEI206	Data Book / Code book (If any)	Gas tables

Course Objectives:

The purpose of taking this course is to:

1	To introduce the fundamental principles of compressible flow and their physical significance in high-speed aerodynamics.
2	To develop understanding of isentropic flow relations and flow behavior through variable area ducts and nozzles.
3	To analyze one-dimensional compressible flows involving shocks, friction, and heat transfer.
4	To provide knowledge of oblique shock waves and expansion phenomena in supersonic flows.
5	To impart concepts of transonic flow and linearized theory relevant to high-speed aerodynamic applications.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamental concepts of compressible flow, including Mach number, governing equations, and flow regimes.	U
CO 2	Apply isentropic relations to determine flow properties in nozzles and variable area ducts.	Ap
CO 3	Analyze one-dimensional flows involving normal shocks, Fanno flow, and Rayleigh flow	An
CO 4	Evaluate the behaviour of oblique shocks and expansion waves in supersonic flows.	E
CO 5	Analyze transonic flow characteristics using linearized theory for high-speed aerodynamic applications.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	-	-	-	1	-	1	3	1
2	3	3	2	-	2	-	-	-	1	-	1	3	2
3	3	3	-	2	2	-	-	-	-	-	1	3	2
4	3	3	2	2	2	-	-	-	-	-	1	3	2
5	3	2	2	-	2	-	-	-	1	-	2	3	2

Course Content	
Fundamentals of Compressible Flow Review of thermodynamics – properties of compressible fluids – Mach number and flow regimes – speed of sound and its physical significance – governing equations (continuity, momentum and energy in integral form) – equation of state – area–velocity relation – choked flow– Crocco's theorem and its physical significance.	**9 Hours**
Isentropic Flow and Nozzle Flows Isentropic relations for compressible flow – flow through variable area ducts – convergent and convergent-divergent nozzles – mass flow rate and choking phenomena – critical properties – use of gas tables and isentropic charts - introduction to Method of Characteristics.	**9 Hours**
One Dimensional Flow with Shocks and Heat Transfer Normal shock relations – Hugoniot equation – Prandtl relation- flow with friction (Fanno flow) – flow with heat transfer (Rayleigh flow) – Pitot-static measurements – compressibility corrections – interpretation of flow properties across shocks.	**9 Hours**
Oblique Shocks and Expansion Waves Oblique shock waves – θ–β–M relation – attached and detached shocks – flow over wedges and cones – Prandtl-Meyer expansion waves – supersonic flow turning – shock polars and hodograph plane analysis – Schlieren & shadowgraph imaging techniques.	**9 Hours**
Transonic and Linearized Flow Small perturbation potential theory – linearized velocity potential equation – linearized pressure coefficient – compressibility corrections – critical Mach number – Drag divergence – Characteristics of swept wings – Transonic area rule – Supersonic airfoils - Introduction to hypersonic aerodynamics.	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. John D. Anderson Jr., Modern Compressible Flow with Historical Perspective, 4th Edition, McGraw-Hill Education, 2021.
2. E. Rathakrishnan, Gas Dynamics, 4th Edition, PHI Learning Pvt. Ltd., 2021.
3. H. W. Liepmann and A. Roshko, Elements of Gas Dynamics, Reprint Edition, Dover Publications, 2002.
4. S. M. Yahya, Fundamentals of Compressible Flow, 5th Edition, New Age International Publishers, 2018.

References:

1. E. L. Houghton and P. W. Carpenter, Aerodynamics for Engineering Students, 7th Edition, Elsevier, 2017.
2. John D. Anderson Jr., Hypersonic and High Temperature Gas Dynamics, 2nd Edition, AIAA Education Series, 2006.

3. A. H. Shapiro, The Dynamics and Thermodynamics of Compressible Fluid Flow, Reprint Edition, Wiley India, 2017.
4. R. D. Zucker and O. Biblarz, Fundamentals of Gas Dynamics, 2nd Edition, Wiley, 2002.
5. John J. Bertin and Russell M. Cummings, Aerodynamics for Engineers, 6th Edition, Pearson, 2013.

Online Educational Resources:

1. https://onlinecourses.nptel.ac.in/noc26_me20
2. https://ocw.mit.edu/courses/16-120-compressible-flow-spring-2003/
3. https://onlinecourses.nptel.ac.in/noc26_ae05

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Lab Visits, End Semester Examination

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	**Dr. Pradeep Kumar Seshadri** Assistant Professor IIT Madras	Mr. Muthukumar S, Dept. of Aero, KCT

Recommended by BoS on	11.06.2026		
Academic Council Approval	No. 31	**Date**	19.06.2026

24AEI302	Aircraft Structures II	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	4, 9 & 13			

Pre-requisite courses	24AEI207	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Apply fundamental principles of solid mechanics to analyze aircraft structural components subjected to unsymmetrical bending.
2	Analyze shear flow distribution and shear center in thin-walled open and closed sections.
3	Evaluate buckling behavior and failure modes of thin-walled plates and stiffened panels.
4	Examine structural behavior of wings and fuselage under aerodynamic and operational loads.
5	Develop experimental skills to determine stress distribution and validate structural theories using laboratory techniques.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze stresses in beams subjected to unsymmetrical bending using K-method, neutral axis and principal axis methods.	An
CO 2	Analyze shear flow, shear centre and torsional behavior of thin-walled open and closed sections.	An
CO 3	Analyze buckling and crippling stresses in thin-walled plates and aircraft structural elements.	An
CO 4	Analyze load distribution and stress behavior in wing and fuselage structural components	An
CO 5	Perform experimental validation of stress distribution, shear centre, torsion and buckling characteristics of aircraft structures.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	3	1	2	1	-	-	1	1	-	1	3	2
2	3	3	2	2	2	-	-	1	1	-	1	3	2
3	3	2	1	2	1	-	-	1	1	-	1	3	1

4	3	3	2	2	2	-	-	1	1	-	1	3	2
5	3	2	1	3	3	-	-	3	2	-	1	3	3

Course Content	
UNSYMMETRICAL BENDING Bending stresses in unsymmetrical sections – K-method – Neutral axis method – Principal axis method – Bending of symmetric sections with skew loads. **Practical Component:** • Unsymmetrical bending of cantilever beam. • Verification of Stress Distribution in a Beam under Unsymmetrical Bending.	**5 Hours** **6 Hours**
SHEAR FLOW IN OPEN SECTIONS Thin-walled beams – Shear flow concept – Shear center – Elastic axis – Effective and ineffective walls – Unsymmetrical beam sections. **Practical Component:** • Determination of shear centre for open sections.	**7 Hours** **4 Hours**
SHEAR FLOW IN CLOSED SECTIONS Bredt–Batho formula – Multi-cell structures – Torsion in closed sections – Approximate methods – Bending with effective and ineffective walls. **Practical Component:** • Determination of Shear centre location for closed section. • Combined Bending and Torsion experiment on thin-walled tubes.	**7 Hours** **7 Hours**
BUCKLING OF PLATES Rectangular plates under compression – Local buckling stress – Crippling stress (Needham & Gerard methods) – Effective width – Inter-rivet and wrinkling failures – Introduction to post-buckling and stiffened-panel design. **Practical Component:** • Determination of stress concentration factor using photoelasticity. • Determination of Stress Distribution in a Rectangular Beam Using Photoelasticity.	**7 Hours** **6 Hours**
STRESS ANALYSIS IN WING AND FUSELAGE Shear resistant web beams – Wagner beam – Load distribution – Lift distribution – V-n diagram – Gust loads. **Practical Component:** • Determination of Flexibility matrix of cantilever beam. • Load distribution and deflection analysis of a wing spar model.	**4 Hours** **7 Hours**

Theory Hours:30	**Tutorial Hours:0**	**Practical Hours:30**	**Project Hours:0**	**Total Hours:60**

Learning Resources

Textbooks:

1. Bruhn. E.H., 'Analysis and Design of Flight vehicles Structures', Tri-state off set company, USA, 1985.
2. Megson, T.H.G., 'Aircraft Structures for Engineering Students', Fifth Edition (Rev.), Butterworth-Heinemann, 2012.

References:

1. Bruce K. Donaldson., 'Analysis of Aircraft Structures', Second Edition, Cambridge University Press., 2008.
2. Peery, D.J., and Azar, J.J., 'Aircraft Structures', Second Edition, McGraw-Hill, 1993.
3. G. Lakshmi Narasaiah, 'Aircraft Structures', CRC Press, 2011.
4. C T Sun, 'Mechanics of Aircraft Structures', Second Edition, Wiley publisher, April 2006.

Online Educational Resources:

1. https://nptel.ac.in/courses/101105084
2. https://ocw.mit.edu/courses/mechanical-engineering/2-080j-structural-mechanics-fall-2013/course-notes/MIT2_080JF13_Lecture11.pdf
3. https://innovationspace.ansys.com/product/unsymmetric-bending-and-plate-deformation/
4. https://www.youtube.com/watch?v=eXdWs7xPM4Q&list=PLv4AhJns8bvCP7FGrBsNtE-YDYlD1koUM&index=5
5. https://eerc01-iiith.vlabs.ac.in/exp/torsion-test-experiment/procedure.html

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Mr Veeramanikandan R Mannschaft Engineering Solutions Pvt Ltd	Dr. S Venkatachalam Karunya Institute of Technology and Sciences	Mr.Raj Kumar G /AERO Dr.K. Naveen Kumar/AERO

Recommended by BoS on	11.06.2026		
Academic Council Approval	No. 31	**Date**	19.06.2026

24AEI303	Computational Fluid Dynamics	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	4, 9 & 13			

Pre-requisite courses	24AEI206	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand solver configuration, fluid material property definition, and computational domain zone setup for formulating CFD problems correctly.
2	Apply discretization schemes, pressure-correction algorithms, and turbulence models through appropriate solver model selection and boundary condition specification.
3	Configure and simulate 2D aerofoil aerodynamic problems using solution initialisation, reference value specification, and force/moment reporting in the CFD solver.
4	Simulate thermal and external aerodynamic flow problems by appropriately setting up the Energy model, Material properties, and solution monitors in the CFD solver.
5	Investigate rotating machinery using the Moving Reference Frame setup and analyse high-speed compressible flow using the density-based solver in the CFD solver.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Configure and explain solver type selection, fluid material property definition, computational zone assignment, and convergence monitoring for a given flow problem.	U
CO 2	Apply discretization schemes, pressure-correction algorithms (SIMPLE, PISO), and turbulence models using the Models and Boundary Conditions facilities in the CFD solver.	Ap
CO 3	Set up and analyse 2D aerofoil CFD simulations using Initialization, Reference Values, and force/moment Reports in the CFD solver.	An
CO 4	Simulate heat transfer and external aerodynamic problems by configuring the Energy model, fluid material properties, and solution monitors in the CFD solver.	Ap
CO 5	Investigate rotating machinery flow using MRF Cell Zone setup and validate high-speed compressible flow results using the density-based solver in the CFD solver.	E

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	3	1	2	1	-	-	1	1	-	1	3	2
2	3	3	2	2	2	-	-	1	1	-	1	3	2
3	3	2	2	3	2	-	-	1	1	-	1	3	2
4	3	3	2	2	2	-	-	1	1	-	1	3	2
5	3	2	1	3	3	-	-	2	2	-	1	3	3

Course Content

CFD SOLVER FUNDAMENTALS AND CFD TOOL SETUP Governing equations in conservative and non-conservative forms – Pressure-based and density-based solvers – Solver type and time setting configuration – Fluid and solid material property definition – Computational zone assignment – Convergence criteria, residual monitoring and grid independence study.	**6 Hours**
Practical Component: (Computational Experiments) Experiment 1: Convergence Control and Residual Monitoring Study using Solver Configuration and Material Property Setup. Experiment 2: Grid Independence Study based Computation using the CFD Solver.	**6 Hours**
DISCRETIZATION, PRESSURE CORRECTION, TURBULENCE MODELLING AND BOUNDARY CONDITIONS Discretization methods and numerical schemes – Explicit and implicit schemes with stability analysis – Pressure correction schemes (SIMPLE, PISO) – Viscous model selection and near-wall treatment – Boundary condition specification – Spatial discretization scheme selection and gradient options.	**6 Hours**
Practical Component: (Computational Experiments) Experiment 3: Pressure Correction Scheme Configuration and Convergence Study using Spatial Discretization and Solution Method Settings. Experiment 4: Turbulence Model Selection and Boundary Condition Sensitivity Study using Viscous Model and Boundary Condition Specifications.	**6 Hours**
CFD SOLVER SETUP FOR EXTERNAL AERODYNAMIC SIMULATIONS Boundary layer growth and flow separation over aerofoil – External aerodynamic domain boundary condition setup – Solution initialisation methods – Reference value specification for force and moment coefficient computation – Force and moment reporting, residual monitoring and surface convergence tracking.	**6 Hours**
Practical Component: (Computational Experiments) Experiment 5: 2D Aerofoil Aerodynamic Performance Computation using Solution Initialisation, Reference Value Specification and Force/Moment Reporting.	**6 Hours**

Experiment 6: Computational Investigation of Fluid Behaviour of Aircraft Wing using Solution Monitors and Post-processing in the CFD Solver.	
HEAT TRANSFER CFD SETUP AND EXTERNAL AERODYNAMICS Energy equation in CFD – Energy model activation and thermal boundary condition types – Thermal material property definition – Secondary flows in curved ducts and external flow over bluff and streamlined bodies – Iteration control settings – Post-processing of thermal and flow field results. **Practical Component: (Computational Experiments)** Experiment 7: Computational Hydro-thermodynamic Investigation in Curved Duct using Energy Model and Thermal Material Setup in the CFD Solver. Experiment 8: Computational Investigation of Fixed Wing UAV Aerodynamics using Iteration Control Settings and CFD Post-processing.	**6 Hours** **6 Hours**
ROTATING REFERENCE FRAME AND HIGH-SPEED COMPRESSIBLE FLOW Single Rotating Frame (SRF) and Multiple Reference Frame (MRF) methods – Rotating domain setup and interface boundary configuration – Compressible flow equations and Mach number regimes – Density-based solver settings and compressibility correction – Ideal gas law and equation of state in fluid property definition – C-D nozzle simulation setup and result validation. **Practical Component: (Computational Experiments)** Experiment 9: Computational Aerodynamic Investigation of Drone Propeller using MRF Rotating Domain Setup in the CFD Solver. Experiment 10: High Speed Compressible Flow Analysis of C-D Nozzle using Density-Based Solver and Ideal Gas Material Setup in the CFD Solver.	**6 Hours** **6 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60

Learning Resources

Textbooks:

1. T. J. Chung, Computational Fluid Dynamics, 2nd Ed., Cambridge University Press, 2014.
2. J. D. Anderson Jr., Computational Fluid Dynamics — The Basics with Applications, McGraw-Hill, 1995.
3. S. V. Patankar, Numerical Heat Transfer and Fluid Flow, CRC Press, 1980.

References:

1. J. H. Ferziger, M. Peric, and R. L. Street, Computational Methods for Fluid Dynamics, 4th Ed., Springer, 2020.
2. C. A. J. Fletcher, Computational Techniques for Fluid Dynamics, Vols. 1 & 2, 2nd Ed., Springer, 2013.
3. C. Hirsch, Numerical Computation of Internal and External Flows, 2nd Ed., Wiley, 2007.
4. K. A. Hoffmann and S. T. Chiang, Computational Fluid Dynamics, Vol. 1, 4th Ed., EES, 2000.
5. J. F. Wendt (Ed.), Computational Fluid Dynamics: An Introduction, 3rd Ed., Springer-Verlag, Berlin, 2008.
6. P. Wesseling, Principles of Computational Fluid Dynamics, Springer, 2001.
7. ANSYS Fluent Theory Guide, Release 23, ANSYS Inc., 2023.
8. ANSYS Fluent User's Guide, Release 23, ANSYS Inc., 2023.

Online Educational Resources:

1. http://nptel.ac.in/courses/101106045/

2. http://nptel.ac.in/courses/112107080/
3. http://nptel.ac.in/courses/103106073/
4. http://nptel.ac.in/courses/112105045/
5. https://ocw.mit.edu/courses/2-29-numerical-fluid-mechanics-spring-2015/
6. https://innovationspace.ansys.com
7. https://confluence.cornell.edu/display/SIMULATION/FLUENT+Learning+Modules

Assessment
SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Mr.R. Vijayanandh /AERO	
Recommended by BoS on	11.06.2026		
Academic Council Approval	No. 31	**Date**	19.06.2026

24AET304	Rocket and Spacecraft Propulsion	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	7, 9 & 13			

Pre-requisite courses	24AEI208	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the physical principles and performance parameters of rocket and spacecraft propulsion systems.
2	Analyze the operation and design of chemical and electrical propulsion systems.
3	Evaluate propellant characteristics, combustion processes, and nozzle performance.
4	Understand spacecraft propulsion requirements for orbit transfer and attitude control.
5	Explore advances in propulsion technology for sustainable space missions

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain the fundamental principles governing rocket and spacecraft propulsion systems.	U
CO2	Analyze the performance of various propulsion systems using thrust, specific impulse, and efficiency parameters.	An
CO3	Compare and select propellants and propulsion systems based on mission requirements.	E
CO4	Apply thermodynamic and fluid flow principles to design rocket nozzles and combustion chambers.	Ap
CO5	Evaluate advanced propulsion systems and their suitability for interplanetary and reusable missions.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Teamwork	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	3	3	2	2	2	-	-	-	2	3	2
2	3	3	3	3	-	-	-	-	-	-	-	3	2
3	3	3	3	3	3	2	-	-	-	-	-	3	2
4	3	3	3	3	3	2	-	-	-	-		3	2
5	3	3	3	3	2	-	2	2	2	-	2	3	2

Course Content	
FUNDAMENTALS OF ROCKET PROPULSION Introduction to rocket propulsion - thrust equation - specific impulse and effective exhaust velocity - rocket performance parameters - staging concepts and flight performance - Tsiolkovsky rocket equation - launch vehicle mission requirements - overview of orbital transfers including Hohmann transfer and gravity-assist maneuvers.	**9 Hours**
CHEMICAL ROCKET PROPULSION SYSTEMS Classification of chemical propulsion systems including solid, liquid, hybrid, cryogenic, and semi-cryogenic rockets - liquid rocket engine components - propellant feed system – injectors - cooling techniques - combustion instability; cryogenic and semi-cryogenic propellants - solid propellant rockets: types of propellants, ignitors , grain configurations and performance characteristics - hybrid rocket principles and applications - comparison of propulsion systems for launch vehicle applications.	**9 Hours**
NOZZLE THEORY AND DESIGN Isentropic flow through nozzles – choked flow, expansion, and contraction effects – characteristic velocity and thrust coefficient – nozzle efficiency and flow separation – types of nozzles: conical, bell-shaped, aerospike – thrust vector control –Throttling, deep-throttle re-ignition, restart capability - introduction to reusable launch vehicle concepts including recovery refurbishment, and propulsive landing, with examples from Falcon 9, Starship, and RLV-TD.	**9 Hours**
SPACECRAFT PROPULSION Space environment and propulsion requirements – orbit raising, station keeping, attitude control and deorbiting – monopropellant and bipropellant systems – cold gas thrusters – Reaction control system (RCS) – thermal management in spacecraft propulsion – Green propellants including Hydroxylammonium Nitrate (HAN), Ammonium Dinitramide (ADN), AF-M315E, and LMP-103S - performance comparison and applications of spacecraft propulsion systems.	**9 Hours**
ADVANCED AND ELECTRIC PROPULSION SYSTEMS Introduction to advanced propulsion concepts; fundamentals of electric propulsion and its advantages over chemical propulsion; electrothermal, electrostatic, and electromagnetic propulsion systems including arcjets, ion thrusters , Hall-effect thrusters, and plasma propulsion - nuclear propulsion - solar thermal propulsion - solar sails, and beamed-energy propulsion - green propellants and sustainable propulsion technologies; propulsion systems for deep-space and interplanetary missions - emerging trends in space transportation and future advanced propulsion systems.	**9 Hours**

Theory Hours:45	Tutorial Hours:0	Practical Hours:0	Project Hours:0	Total Hours:45

Learning Resources

Textbooks:

1. George P. Sutton and Oscar Biblarz, ‘Rocket Propulsion Elements’, John Wiley, New York, USA, 2017.
2. B. N. Suresh and K. Sivan, Integrated Design for Space Transportation System. New Delhi, India: Springer India, 2015.
3. Humble, R. W., Henry, G. N., & Larson, W. J. Space Propulsion Analysis and Design, McGraw-Hill, 2017.
4. Mishra D.P., ‘Fundamentals of Rocket Propulsion’ CRC Press, USA 2017.

References:

1. Gordon Oates, ‘Aero Thermodynamics of Gas Turbine and Rocket Propulsion’, AIAA, 1997.
2. J. W. Cornelisse, H. F. R. Schoyer, and K. F. Wakker, ‘Rocket Propulsion and Spaceflight Dynamics’, Pitman, London, 1979.

3. Kou. K. K and Summerfield. M., “Fundamental Aspects of Solid Propellant Rockets”, Progress in Astronautics and Aeronautics, AIAA, Vol. 90, 1982.
4. Barrere. M, ‘Rocket Propulsion’, Elsevier Publishing Company, New York, 1960.
5. Norazila Othman, Subramaniam Krishnan, and Wan Khairuddin Wan Ali, ‘Design and Development of Hydrogen Peroxide Monopropellant Thruster: Basic Theory and Performance Calculations’, Lambert Academic Publishers, 2011.

Online Educational Resources:

1. https://ocw.mit.edu/courses/16-512-rocket-propulsion-fall-2005/
2. https://archive.nptel.ac.in/courses/101/104/101104078/
3. https://www.coursera.org/learn/basics-of-rocket-science

Assessment (Theory course)
SA I and II, Activity and Learning Task (One-minute paper, reflective journal, Open-ended questions), MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
Dr. P. Sasikumar, Senior Scientist Vikram Sarabhai Space Centre (VSSC) Thiruvananthapuram	Dr.AP.Haran Professor Park College of Technology	Dr.R.Arul Prakash/AERO

Recommended by BoS on	11.06.2026		
Academic Council Approval	No. 31	**Date**	19.06.2026

24INM202	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY (Common to All Branches)	L	T	P	J	C
		1	0	2	0	2
HS		SDG	6, 13, 15			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:

The purpose of taking this course is to:

1	To introduce the importance, types, and conservation strategies of natural resources, with a focus on sustainable practices in water and food management.
2	To understand the structure and function of ecosystems and biodiversity, and explore the need for conservation through the study of hotspots and global environmental concerns.
3	To examine the causes and effects of environmental degradation, including pollution and waste management, and to promote mitigation strategies for sustainable development.
4	To provide knowledge of the legal and institutional frameworks for environmental protection in India and globally, including critical environmental acts and enforcement challenges.
5	To explore conventional and alternative energy resources, and to assess methods for energy conservation and carbon footprint reduction through audits and sustainability measures.

Course Outcomes

After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO1	Apply the concept of natural resource conservation to demonstrate sustainable practices	Ap
CO2	Analyse the structure, function, and adaptive capacity of ecosystems to categorize threats and conservation strategies for biodiversity.	An
CO3	Analyse various forms of environmental degradation and propose management and preventive solutions.	An
CO4	Apply national environmental laws and frameworks in the personal and professional contexts	Ap
CO5	Design strategies using renewable energy principles to develop sustainable energy utilization plans through audits and footprint analysis to transfer a healthy environment for future generations.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2	–	–	–	–	2	3	–	1	–	–	1	–
2	2	2	–	–	–	2	3	1	–	–	–	1	–
3	2	3	–	2	–	3	3	1	–	–	–	1	1
4	–	2	–	–	–	3	3	3	1	2	2	–	–
5	2	2	3	2	2	3	3	–	1	2	2	2	2

Course Content

NATURAL RESOURCES **Introduction to Natural resources:** Types, significance, and conservation strategies **Water resources:** Utilization, management practices, and conservation strategies - rainwater harvesting methods – Water distribution system audit **Food resources:** Challenges of food security in India - impact of modern agriculture, and environmental concerns related to fertilizers and pesticides. **Practical Component:** • Parameter Testing: Water / Effluent / Soil/Fertiliser • Simulation Experiments • Online Course	**3 Hours** **10 Hours**
ECOSYSTEM AND BIODIVERSITY **Ecosystem:** Structure and function of an ecosystem - ecosystem resilience and adaptive capacity **Biodiversity:** Values of biodiversity - Hot Spot of biodiversity (in the Himalayas, the Western Ghats, the Indo-Burma region, and the Gulf of Mannar) - Threats to biodiversity. **Conservation Strategies:** Emerging Issues in Biodiversity Conservation - Citizen science - In-situ and Ex-situ conservation of biodiversity. **Practical Component:** • Documentation of biodiversity in the campus	**3 Hours** **6 Hours**
ENVIRONMENTAL DEGRADATION AND MANAGEMENT **Pollution**: Causes, effects and control measures of Air pollution, Water pollution - Role of an individual in prevention of pollution	**3 Hours**

Waste management: Circular Economy vs. Linear Economy - Disposal of solid wastes - Treatment of Liquid wastes **Disaster Management**: Mitigation strategies and Readiness **Practical Component:** • Waste Management and Resource recovery in Campus • Documentation of Environmental Data Resources and Monitoring Tools.	**6 Hours**
LEGAL FRAMEWORK FOR ENVIRONMENTAL PROTECTION IN INDIA **Global and National Initiatives**: United Nations Sustainable Development Goals - Coastal Regulation Zone - Environmental impact assessment **Environmental Legislation in India**: Key Legal and Regulatory Terminology in India – Valuation of Ecosystem Services and integration of Acts in the workplace - Plastic Waste Management Rules - E-Waste Management Rules - Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act **Implementation Challenges**: Issues involved in enforcement of environmental legislation **Practical Component:** • Online Course	**3 Hours** **2 Hours**
ENERGY MANAGEMENT **Energy Resources:** Energy Demand and Urban energy Challenges - Necessity of alternate energy methods - Renewable and Non- renewable energy resources - Carbon footprint and carbon credit – Sustainable energy utilization – Case study **Energy Audits** – Purpose, methodology, and common instruments used **Practical Component**: • Documentation of Energy usage through Carbon foot print calculation - Personal as well as Institutional	**3 Hours** **6 Hours**

Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 45

Learning Resources

References:

1. Bharucha, E. (2021). Textbook of environmental studies for undergraduate courses (3rd ed.). Orient BlackSwan / Universities Press - Hyderabad, India.
2. Miller, G. T., & Spoolman, S. E. (2014). Environmental science (14th ed.). Cengage India
3. Anubha Kaushik & C.P. Kaushik (2024). Perspectives in Environmental Studies (8th ed.). New Age International Publishers, New Delhi.
4. Masters, G. M., & Ela, W. P. (2013). Introduction to environmental engineering and science (3rd ed.). Pearson Education, New Delhi.

5. Leelakrishnan, P. (2018). Environmental law in India (3rd ed.). LexisNexis Butterworths, New Delhi.
6. Botkin, D. B., & Keller, E. A. (2014). Environmental science: Earth as a living planet (9th ed.). Wiley, Hoboken, NJ.
7. Armstrong, J. (2023). The future of energy: The 2023 guide to the energy transition. Independently published.
8. Easton, T. (Ed.). (2017). Taking sides: Clashing views on environmental issues (17th ed.). McGraw-Hill Education, New York, NY.
9. Ishwaran, N. (2022). Ecosystem services and economic valuation. New Delhi: TERI Press.

Online Resources (Weblinks)

- https://www.youtube.com/watch?v=j4Z6WmTnhRQ How to Conduct a Water Audit in Institutions
- https://www.youtube.com/watch?v=_OKYio2Yk9U India's Food Security Challenge
- https://www.youtube.com/watch?v=IjNT9Z2OLf4 India's Biodiversity Hotspots
- https://www.youtube.com/watch?v=_c_sJIEJY4M What is Citizen Science?
- https://www.youtube.com/watch?v=1HZR3GyzFZc What is a Circular Economy
- https://www.youtube.com/watch?v=6_tLYyR_3Vo Environmental Law and Acts in India
- https://www.youtube.com/watch?v=kGcrYkHwE80 Introduction to SDGs
- https://www.youtube.com/watch?v=V__eNSHdChA Conducting an Energy Audit
- https://www.youtube.com/watch?v=dUqTt5Qrxn8 - What is Your Carbon Footprint?

Assessment (Embedded course)

CAT, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)
Lab Workbook, Report Submission

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. Muthuraja Perumal General Manager - Research & Development Rohith Industries, APIIC Industrial Park, Andhra Pradesh	Dr. Mathivanan Packiarajan University of Michigan Ann Arbor, MI USA Dr. Venkatakrishnan Professor, School of Chemical Sciences Indian Institute of Technology (Mandi) Himachal Pradesh India	Faculty Of Chemistry Department of Chemistry

Recommended by BoS on			
Academic Council Approval		**Date**	

Semester-6

24AET305	Aviation Logistics and Supply Chain Management	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To understand the fundamentals of aviation logistics and supply chain management in global aviation operations.
2	To analyze aviation inventory, warehousing, transportation, and distribution systems.
3	To study cargo handling, cold chain logistics, and regulatory requirements in aviation logistics.
4	To explore air cargo operations, safety practices, and international aviation regulations.
5	To evaluate emerging technologies, digitalization, AI, and future trends in aviation supply chain management.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the concepts, functions, and strategies of aviation logistics and supply chain management.	U
CO 2	Apply inventory control, warehousing, and distribution techniques in aviation logistics systems.	Ap
CO 3	Analyze cargo handling, cold chain logistics, and aviation transportation networks.	An
CO 4	Examine aviation cargo regulations, safety standards, and risk management practices.	An
CO 5	Evaluate modern technologies and future challenges in aviation supply chain management.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	1	-	-	1	1	2	2	-
2	3	3	2	2	2	1	-	-	1	2	2	2	2
3	3	3	2	3	3	2	-	1	1	1	2	3	2
4	2	3	3	2	2	3	3	1	2	1	2	2	1
5	3	3	3	3	3	3	2	2	2	2	3	3	3

Course Content

Introduction to Aviation Logistics & Supply Chain Management Definition and scope of logistics in aviation – concepts – functional applications (HR, Marketing, Operations, Finance, IT) – importance of SCM – aviation industry supply chain structure – SCM concepts and frameworks – demand forecasting in aviation – procurement and supplier relationship management – lean and agile supply chains – SCM decisions and skills – strategy formulation – integration with global supply chain. Case Studies: Boeing, Airbus, and MRO (Maintenance, Repair, Overhaul).	**9 Hours**
Aviation Inventory, Warehousing and Distribution Types of aviation inventory (spares, consumables, rotables) – inventory control techniques (stock levels, ABC, EOQ, JIT) – aviation warehousing systems and automation – AI-based demand forecasting – predictive maintenance – warehouse robots – automated sorting & picking – smart fulfilment centres. Transportation and distribution in aviation – ground handling and airport logistics – multimodal transport in aviation supply chains – route optimization – distribution networks for aerospace parts.	**9 Hours**
Cargo Handling Agents and Cool Logistics Cool chain business – smart sensors in vehicles – live shipment tracking – temperature monitoring (cold chain) – cold chain logistics for sensitive materials – industry applications – CCP & L – digital twin & control tower systems – last-mile delivery innovations – case studies.	**9 Hours**
Air Cargo, Regulatory and Safety Aspects Air cargo logistics – core systems in aviation operations – air freight – airport types – airport operations – ground handling and airport logistics – multimodal transport in aviation supply chains – distribution networks for aerospace parts – regulatory and safety aspects – ICAO, FAA, EASA regulations – customs and international trade compliance – safety and risk management in aviation	**9 Hours**

logistics – hazardous materials handling – IATA Dangerous Goods Regulations (DGR) – export/import cargo flow.	
Technology in Aviation SCM & Future Digitalization of aviation supply chains – reservation systems – flight planning software – IoT-enabled cargo tracking systems – blockchain for aviation parts authenticity – AI and predictive analytics in logistics – AI & smart logistics – cyber security and aviation data – future challenges – environmental issues.	**9 Hours**

Theory	Tutorial	Practical	Project	Total
Hours: 45	**Hours: 0**	**Hours: 0**	**Hours: 0**	**Hours: 45**

Learning Resources

Textbooks

1. Michael Sales (2016), Aviation Logistics: The Dynamic Partnership of Air Freight and Supply Chain Management, Kogan page, UK
2. Michael Sales & Sebastiaan Scholte (2023), Air Cargo Management: Air Freight and the Global Supply Chain (2nd Edition), Routledge, London
3. Martin Christopher, (2023), Logistics and Supply Chain Management (5th Edition/Latest), Pearson, UK
4. Michael Hugos, Essentials of Supply Chain Management, John Wiley & Sons, Hoboken, NJ, USA (2024).
5. Gwynne Richards, Warehouse Management, Kogan Page, London, UK (2022).

References

1. D. R. Vieira & P. L. Loures, MRO Fundamentals and Strategies (Journal/Book Chapters), IJCA, New York, USA (2016).
2. IATA, Temperature Control Regulations (TCR), IATA Publishing, Montreal, Canada (Annual/2026).
3. Peter S. Morrell, Moving Boxes by Air, Routledge, London, UK (2018).
4. IATA, Dangerous Goods Regulations (DGR), IATA Publishing, Montreal, Canada (Annual).
5. Amit Sinha et al., Digital Supply Networks, McGraw-Hill, New York, NY, USA (2020).
6. Jai Singh Arun et al., Blockchain for Business, Addison-Wesley (Pearson), Boston, MA, USA (2019).

Online Educational Resources:

1. ICAO Training and Aviation Logistics Resources.
2. IATA E-Learning and Cargo Handling Modules.
3. NPTEL Courses on Supply Chain Management and Logistics.
4. FAA Aviation Safety and Cargo Operations Resources.

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Mr. R.Arun Kumar
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AET306	Flight Dynamics	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	9 & 11			

Pre-requisite courses	24AEI206	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	To introduce the fundamental principles of flight mechanics, including forces, moments, and atmospheric effects on aircraft.
2	To develop understanding of aircraft performance in level, climbing, gliding, and accelerated flight conditions.
3	To analyze the performance characteristics of aircraft during take-off, landing, and maneuvering flight.
4	To provide knowledge of longitudinal stability and control of aircraft.
5	To impart concepts of lateral and directional stability and control for safe and efficient flight operation.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamental principles of flight mechanics, including forces, moments, and equations of motion	U
CO 2	Apply performance principles to study the aircraft behavior in level, climbing, and gliding flight	Ap
CO 3	Analyze aircraft performance during accelerating flight, including take-off, landing, and turning maneuvers.	An
CO 4	Evaluate longitudinal stability and control characteristics of an aircraft.	E
CO 5	Analyze lateral and directional stability and control for different flight conditions.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	-	-	-	1	-	1	3	1
2	3	3	2	-	2	-	-	-	1	-	1	3	2
3	3	3	2	2	2	-	-	-	-	-	1	3	2
4	3	3	2	2	2	-	-	-	-	-	1	3	2
5	3	3	2	2	2	-	-	-	-	-	1	3	2

Course Content	
Fundamentals of Flight Mechanics Atmospheric properties and International Standard Atmosphere – pressure, temperature and altitude relationships – forces and moments acting on an aircraft – equilibrium of forces in steady flight – introduction to equations of motion of a rigid aircraft – airspeed measurement (true, indicated, calibrated and equivalent airspeed) – drag components and drag polar – methods of drag reduction.	**9 hrs**
Aircraft Performance in Level and Climbing Flight Straight and level flight – thrust and power required and available – effect of altitude on performance – conditions for minimum drag and minimum power – climbing flight performance – Rate of climb and angle of climb – gliding flight – Range and Endurance – basic performance optimization.	**9 hrs**
Accelerated Flight and Maneuvering Performance Accelerating flight – take-off and landing performance – turning flight (horizontal and vertical turns) – load factor – pull-up and pull-down maneuvers – maximum turn rate and minimum turn radius – V–n diagram – performance limits and operational constraints.	**9 hrs**
Longitudinal Stability and Control Degrees of freedom of an aircraft – static and dynamic stability concepts – longitudinal static stability – Neutral point and static margin – contribution of wing, tail and fuselage – control effectiveness – elevator characteristics – trim conditions – introduction to dynamic stability - phugoid and short period modes.	**9 hrs**
Lateral and Directional Stability and Control Side-slip and yawing motion – dihedral effect – lateral and directional stability derivatives – aileron and rudder control – adverse yaw and aileron reversal – directional stability and weathercock stability – spiral and Dutch roll modes – spin and autorotation – basic control strategies.	**9 hrs**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:** 45

Learning Resources

Textbooks:

1. John D. Anderson Jr., Aircraft Performance and Design, 1st Edition, McGraw-Hill, 2011. (Standard text for performance topics)
2. Robert C. Nelson, Flight Stability and Automatic Control, 2nd Edition, McGraw-Hill, 1998 (Reprint). (Widely used for stability concepts)
3. Bandu N. Pamadi, Performance, Stability, Dynamics, and Control of Airplanes, 3rd Edition, AIAA Education Series, 2015. (Comprehensive combined reference — very relevant to your merged course)
4. Bernard Etkin and Lloyd Duff Reid, Dynamics of Flight: Stability and Control, 3rd Edition, Wiley, 1996 (Reprint). (Classic text for dynamic stability)
5. H. H. Hurt Jr., Aerodynamics for Naval Aviators, Revised Edition, FAA, 2012. (Good for conceptual clarity and performance basics)

References:

1. John D. Anderson Jr., Introduction to Flight, 9th Edition, McGraw-Hill, 2016.
2. Martin E. Eshelby, Aircraft Performance Theory and Practice, 1st Edition, Elsevier, 2012.
3. C. D. Perkins and R. E. Hage, Airplane Performance, Stability and Control, Reprint Edition, Wiley, 2012.
4. Warren F. Phillips, Mechanics of Flight, 2nd Edition, Wiley, 2010.
5. Jan Roskam, Airplane Flight Dynamics and Automatic Flight Controls, Part I, 2nd Edition, DARcorporation, 2001.

Online Educational Resources:

1. https://nptel.ac.in/courses/101106041
2. https://nptel.ac.in/courses/101104013
3. https://ocw.mit.edu/courses/16-333-aircraft-stability-and-control-fall-2004/
4. http://www.princeton.edu/~stengel/MAE331Lectures.html

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Lab Visits, End Semester Examination

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-		Mr. Muthukumar S, Dept, of Aero, KCT

Recommended by BoS on			
Academic Council Approval		**Date**	

24AEI307	Finite Element Analysis	L	T	P	J	C
		2	0	2	0	3
Professional Core		SDG	4, 9 & 13			

Pre-requisite courses	24AEI207	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the general steps, mathematical foundations, and convergence criteria of the Finite Element Method.
2	Derive and apply stiffness matrices for 1D bar, truss, and beam elements under mechanical and thermal loading using ANSYS APDL.
3	Solve plane stress, plane strain, and axisymmetric structural problems using CST and quadrilateral elements in ANSYS.
4	Apply isoparametric formulation with Gaussian quadrature and perform 3D composite structural analysis using ANSYS Workbench.
5	Perform free vibration and transient dynamic analysis of structural components using ANSYS Workbench.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify the mathematical model for simple and complex engineering problems using FEM approach.	Ap
CO 2	Calculate stress, strain, and displacement value of simple 1-D problems using ANSYS APDL.	Ap
CO 3	Solve complex axisymmetric problems under various boundary conditions using ANSYS.	Ap
CO 4	Apply isoparametric formulation with Gaussian quadrature and perform 3D composite structural analysis using ANSYS Workbench.	Ap
CO 5	Analyse free vibration and transient dynamic structural problems using ANSYS Workbench.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	3	1	2	1	-	-	-	-	-	1	3	2

2	3	3	2	2	2	-	-	-	-	-	1	3	2
3	3	2	2	3	2	-	-	-	-	-	1	3	2
4	3	3	2	2	2	-	-	-	-	-	1	3	2
5	3	2	1	3	3	-	-	-	-	-	1	3	3

Course Content

INTRODUCTION Review of various approximate methods - Rayleigh Ritz's method - Galerkin's method - Finite difference method - Governing equation of Finite Element Method - Convergence criteria - Principle of Minimum Potential Energy - Assembly of global stiffness matrix - Boundary condition application. **Practical Component:** • Stepped Bar Analysis using ANSYS APDL (LINK180) • Bar under Distributed Load - Mesh Convergence Study using ANSYS APDL	**6 Hours** **6 Hours**
DISCRETE ELEMENTS Bar element with uniform section and varying section - Mechanical and thermal loading - Spring element stiffness matrix - Truss analysis - Beam element - Problems for various loading and boundary conditions - Use of local and natural coordinates - One dimensional heat transfer problems - Governing equation for 1D heat conduction - Element stiffness matrix for heat transfer - Steady state heat transfer in fin. **Practical Component:** • Static Analysis of a 2D Truss using ANSYS APDL (LINK180) • Steady State Thermal Analysis of a 1D Fin using ANSYS Workbench (Steady-State Thermal)	**6 Hours** **6 Hours**
CONTINUUM ELEMENT Plane stress and Plane strain problems - Constant Strain Triangular (CST) element - Stiffness matrix - Introduction to Linear Strain Triangular (LST) element - Axisymmetric problems - Axisymmetric load vector - Two-dimensional heat transfer problems - Derivation of element matrices for 2D heat conduction - Steady state heat transfer formulation for 2D domains - Torsion problems. **Practical Component:** • Plane Stress Analysis of a Plate with Central Hole using ANSYS APDL / Workbench (PLANE182) • Steady State Thermal Analysis of a 2D Plate with Heat Source using ANSYS Workbench (Steady-State Thermal)	**6 Hours** **6 Hours**
ISOPARAMETRIC ELEMENT Introduction to isoparametric elements - Shape functions for 4-noded quadrilateral element - Natural coordinate system - Cartesian coordinate transformation - Jacobian matrix - Stiffness matrix and consistent load vector - Gaussian integration. **Practical Component:** • Steady State Structural Analysis of a 3D Composite Beam under Axial and Bending Load (ANSYS Workbench) • Steady State Structural Analysis of a 3D Composite Plate under Transverse Loading (ANSYS Workbench)	**6 Hours** **6 Hours**

STRUCTURAL DYNAMICS Consistent mass matrix and lumped mass matrix - Free vibration analysis - Eigenvalue problem - Natural frequencies and mode shapes - Longitudinal vibration of bars - Transverse vibration of beams - Transient dynamic analysis - Newmark's direct integration method - Introduction to nonlinear FEA and advanced ANSYS concepts.	**6 Hours**
Practical Component: • Modal Analysis of a Cantilever Beam using ANSYS Workbench (BEAM188) • Transient Dynamic Analysis of a Simply Supported Beam using ANSYS Workbench	**6 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60

Learning Resources

Textbooks:

1. T. J. Chung, Computational Fluid Dynamics, 2nd Ed., Cambridge University Press, 2014.
2. Tirupathi R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite Elements in Engineering, 4th Ed., Prentice Hall India, 2012.
3. Robert D. Cook, David S. Malkus, and Michael E. Plesha, Concepts and Applications of Finite Element Analysis, 4th Ed., John Wiley and Sons, 2008.

References:

1. J. N. Reddy, An Introduction to Finite Element Method, 4th Ed., McGraw-Hill, 2018.
2. D. L. Logan, A First Course in the Finite Element Method, 7th Ed., Cengage, 2017.
3. O. C. Zienkiewicz et al., The Finite Element Method: Its Basis and Fundamentals, 7th Ed., Butterworth-Heinemann, 2013.
4. H. V. Lakshminarayana and S. R. Srivatsa, Finite Element Modelling for Engineering Analysis, Yes Dee, 1st Ed., 2017.

Online Educational Resources:

1. https://nptel.ac.in/courses/112104115/
2. https://nptel.ac.in/courses/112104116/
3. https://ocw.mit.edu/courses/2-29-numerical-fluid-mechanics-spring-2015/
4. https://innovationspace.ansys.com (ANSYS Learning Hub — FEA tutorials)
5. https://confluence.cornell.edu/display/SIMULATION/FEM+Learning+Modules

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	-	Mr.R. Vijayanandh /AERO

Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AET308	Aerospace Control Systems	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4			

Pre-requisite courses	24MAI121	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamental concepts of control systems, including modeling of mechanical, electrical, and electromechanical systems using transfer functions and state-space approaches.
2	To analyze the time-domain behavior of linear time-invariant (LTI) systems.
3	To understand the concept of system stability using pole location and Routh–Hurwitz criterion for stability assessment.
4	To develop the ability to design control systems using classical methods such as root locus, PID controllers, and compensation techniques.
5	To provide knowledge of frequency response analysis and enable students to assess system performance and stability using Bode and Nyquist methods.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the concept of open-loop and closed-loop control systems.	U
CO 2	Model physical systems in transfer function and state-space representations, including linearization of simple nonlinear systems.	Ap
CO 3	Analyse the time-domain response of LTI systems for transient and steady-state performance characteristics.	An
CO 4	Analyse the stability of control systems using pole locations and Routh–Hurwitz criterion.	An
CO 5	Design control systems with PID control and compensation methods using root locus techniques.	Ap
CO 6	Analyze control systems in the frequency domain using Bode plots and Nyquist criteria.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	2	2	-
2	3	3	2	2	2	-	-	-	-	-	2	3	-

3	3	3	2	2	3	-	-	-	-	-	2	3	3
4	3	3	2	2	3	-	-	-	-	-	2	3	3
5	3	3	3	2	3	-	-	-	-	-	2	3	3
6	3	3	2	2	3	-	-	-	-	-	2	3	3

Course Content

MODELING OF PHYSICAL SYSTEMS Control system—objectives and components; Open-loop and closed-loop control; Feedback and its effects; LTI systems and its impulse response; Laplace Transform and Transfer function; Poles and zeros of physical systems; Mathematical modelling of mechanical, electrical and electromechanical systems; Aerospace examples—mass-spring-damper aircraft pitch dynamics, servo actuator; State-space representation; Non-linear Systems; Finding the fixed points of non-linear systems; Linearization about the fixed points of the systems; Aerospace state-space examples.	**10 Hours**
TIME-DOMAIN ANALYSIS Transient response for initial conditions and forced response; Step response of first-order and second-order systems, higher-order systems and second-order approximation; Transient response specifications; Steady-state error and system type; Aerospace handling-quality interpretations; Cooper-Harper levels; MIL-STD-1797; Performance specifications for autopilots using MATLAB.	**10 Hours**
STABILITY ANALYSIS AND FREQUENCY-DOMAIN METHODS Concept of stability; Effect of location of poles on system stability; Routh–Hurwitz criterion and special cases; Stability design using Routh's criterion; Sinusoidal response of LTI systems; Frequency response characteristics; Bode plots; Gain margin and phase margin; Nyquist stability criterion; Aerospace application—gain and phase margins for safe handling-qualities and autopilot certification; MATLAB demonstrations.	**9 Hours**
CONTROLLER DESIGN Root locus analysis; Proportional-Integral (PI), Proportional-Derivative (PD), Proportional-Integral-Derivative (PID) controls; Lag, lead, lag-lead compensation; Ziegler–Nichols method of PID tuning; Controllability and Observability, Full-state feedback control design; Brief introduction to Linear Quadratic Regulator (LQR) and Model Reference Adaptive Control (MRAC).	**10 Hours**
AEROSPACE CONTROL APPLICATIONS Stability Augmentation System (SAS)—pitch, yaw, roll dampers; Autopilot architecture; Fly-by-wire (FBW) control law architectures; UAV Guidance-Navigation-Control (GNC); Quadcopter PID control; Spacecraft attitude control; MATLAB/Simulink demonstrations.	**6 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Norman S. Nise, Control Systems Engineering, 8th Edition, Wiley, Hoboken, NJ (2019).

2. J. David Powell, Abbas F. Emami-Naeini, and Christina M. Ivler, Feedback Control of Dynamic Systems, 9th Edition, Pearson, Upper Saddle River, NJ (2025).
3. Katsuhiko Ogata, Modern Control Engineering, 5th Edition, Prentice Hall, Upper Saddle River, NJ (2010).
4. John H. Blakelock, Automatic Control of Aircraft and Missiles, 2nd Edition, Wiley, 1991.
5. Brian L. Stevens, Frank L. Lewis, and Eric N. Johnson, Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems, 3rd Edition, Wiley, 2015.
6. Donald McLean, Automatic Flight Control Systems, Prentice Hall, 1990.

References

1. Farid Golnaraghi and Benjamin C. Kuo, Automatic Control Systems, 10th Edition, McGraw-Hill, NJ (2017).
2. Li Qiu and Kemin Zhou, Introduction to Feedback Control, Prentice Hall, Upper Saddle River, NJ (2010).
3. P. N. Paraskevopoulos, Modern Control Engineering, Marcel Dekker, New York (2002).
4. Robert C. Nelson, Flight Stability and Automatic Control, 2nd Edition, McGraw-Hill, 2017.
5. Marcel J. Sidi, Spacecraft Dynamics and Control: A Practical Engineering Approach, Cambridge University Press, 2000.

Online Educational Resources:

1. https://ocw.mit.edu/courses/16-06-principles-of-automatic-control-fall-2012/
2. https://nptel.ac.in/courses/112107240
3. https://ntrs.nasa.gov (Cooper-Harper / MIL-STD-1797 handling-qualities material and NASA's Cooper-Harper rating scale report from NASA Technical Reports Server)

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Open Book Tests, Simulation based Design, End Semester Examination

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
Mr. R. V. Ramkumar, Scientist 'F', Centre for Airborne Systems (DRDO), Bengaluru	Dr. Rajesh Joseph Abraham Associate Professor, Department of Avionics, Indian Institute of Space Science and Technology (IIST), Trivandrum	Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on		
Academic Council Approval	No.	**Date**

24INM002	Disaster Management and Preparedness	L	T	P	J	C
		2	0	0	0	2
MC		SDG	3, 9, 11 & 15			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Provide foundational knowledge on natural and anthropogenic disasters, their causes, impacts, and risk frameworks.
2	Understand DRR concepts, early warning principles, and preparedness planning
3	Foster awareness of national and global disaster management policies and frameworks
4	Build skills for disaster mitigation using digital tools

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	understand disaster types, key terminologies, and major global and Indian disaster profiles.	U
CO 2	analyse disaster impacts and evaluate early warning systems and agencies.	An
CO 3	apply disaster risk reduction (DRR) principles and the disaster management cycle for preparedness and response.	Ap
CO 4	understand disaster management roles, policies, and institutional frameworks.	U
CO 5	apply digital tools and technologies for disaster mitigation and resilient planning.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	2	1	-	-	3	2	1	1	-	2	1	1
CO2	2	3	2	3	-	2	-	-	-	-	2	3	2
CO3	1	2	3	3	2	3	1	2	1	-	2	3	2
CO4	2	1	2	2	3	2	1	3	2	-	1	3	2
CO5	2	2	1	-		3	3	1	2	2	3	3	2

Course Content	
Introduction Introduction to Disaster - Types of disasters - Natural, anthropogenic, hybrid; global and Indian disaster profiles; key terminologies (hazard, vulnerability, exposure, resilience); historical case studies (tsunamis, earthquakes, floods, pandemics); overview of Sendai Framework priorities	**06 Hours**
Disaster Impacts and Early Warning Systems Disaster Impacts - Environmental, Physical, Social, Ecological, Economic, Political; Health, Psycho-social issues; Demographic aspects (gender, age, special needs); Hazard locations; Global and National disaster trends; Climate change and Urban disasters - Community-based EWS; Role of IMD, INCOIS, CWC, ISRO.	**06 Hours**
Disaster Preparedness and Response Mechanism (4 hours) Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response; Incident Response System (IRS), emergency communication systems; relief distribution planning.	**06 Hours**
Disaster Management Roles & Frameworks Roles and responsibilities of government, Community and youth participation, NDRF/SDRF/ NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority. DM Act 2005, National/State disaster plans; International frameworks -UNOCHA, UNDRR; Climate change linkages	**06 Hours**
Digital Tools and Mitigation Strategies for DRR NDMA/SDMA/DDMA structures, GIS, remote sensing, drones, AI-based early warning, satellite data; social media analytics; ICT tools for humanitarian logistics; digital twins for simulation - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (sustainable and environmentally friendly recovery; reconstruction and development methods.	**06 Hours**

Theory Hours:	**30**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**30**

Learning Resources

Textbooks:

1. Bhandani, R. K. (2006). *An overview on natural and man-made disasters and their reduction*. Council of Scientific and Industrial Research (CSIR).
2. Sharma, V. K. (2013). *Disaster management in India: Challenges and strategies*. Indian Institute of Public Administration.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
5. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
6. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC.

References:
1. Srivastava, H. N., & Gupta, G. D. (2018). *Management of natural disasters in developing countries*. Daya Publishing House. 2. Murthy, D. B. N. (2007). *Disaster management: Text and case studies*. Deep & Deep Publications Pvt. Ltd.
Online Educational Resources:
1. http://ndma.gov.in/ (Home page of National Disaster Management Authority) 2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

Assessment (Theory course)
Project based learning on real time case Studies (programme specific/trans-disciplinary) - Project Reviews and Report Submission.

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Recommended by BoS on	05.12.2025		
Academic Council Approval	No.29	**Date**	24/12/2025

24AEP309	Aircraft Systems and Maintenance Laboratory	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4 & 9			

Pre-requisite courses	24AET210	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Provide hands-on knowledge of aircraft systems and subsystems.
2	Develop skills in inspection, testing, troubleshooting, and maintenance.
3	Familiarize students with aircraft engines, instruments, and control systems.
4	Enable practical understanding of airframe and aero engine maintenance procedures

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Evaluate aircraft systems through inspection and testing procedures.	Ap
CO 2	Demonstrate the functioning of hydraulic, pneumatic, and electrical systems.	Ap
CO 3	Perform dismantling and assembly of aircraft piston and jet engines.	Ap
CO 4	Identify defects in aircraft systems and engine components.	An
CO 5	Apply troubleshooting and maintenance practices in aircraft systems.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	2	1	2	2	1	1	2	2	1	2	3	2
CO2	3	2	2	2	3	1	1	2	2	1	2	3	3
CO3	3	2	3	2	3	1	1	2	2	1	2	3	3
CO4	3	3	2	3	2	2	1	1	2	1	2	3	2
CO5	2	3	2	3	3	2	2	2	2	2	3	3	3

Course Content (Exercises)
1. Inspection of primary and secondary controls of Cessna 172 aircraft
2. Demonstration and testing of aircraft hydraulic system
3. Demonstration and testing of aircraft pneumatic system

4. Inspection of aircraft instruments and their functions in Cessna 172
5. Preparation of Butt and Lap Joints by Arc Welding and Evaluation of Weld Quality
6. Fabrication of Lap and Butt Joints Using Riveting
7. Removal and fitment of Wings, Empennage and Undercarriage
8. Propeller pitch setting and balancing
9. Dismantling and assembly of aircraft piston engine
10. Jet engine – identification of components and defects

Theory Hours:		**Tutorial Hours:**		**Practical Hours:**	**30**	**Project Hours:**	**Total Hours:**	**30**

Learning Resources
Textbooks:
1. E. H. J. Pallett, Aircraft Instruments – Principles and Applications, 2nd Edition, Longman, 1981. 2. E. H. J. Pallett and S. Coyle, Automatic Flight Control, 4th Edition, Blackwell Science, 1993. 3. Irwin Treager, Aircraft Gas Turbine Engine Technology, 3rd Edition, McGraw-Hill, 1997. 4. Dale Crane, Aircraft Maintenance Technician Handbook, Aviation Supplies & Academics, Latest Edition.
References:
1. Ian Moir and Allan Seabridge, Aircraft Systems – Mechanical, Electrical and Avionics Subsystems Integration, 2nd Edition, Professional Engineering Publishing, 2001. 2. Ian Moir, Allan Seabridge and Malcolm Jukes, Civil Avionics Systems, 2nd Edition, Wiley, 2013.
Online Educational Resources:
1. FAA – *Pilot's Handbook of Aeronautical Knowledge* https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/ 2. MIT OpenCourseWare – Aircraft Systems Engineering https://ocw.mit.edu/courses/aeronautics-and-astronautics/ 3. NPTEL – Aircraft Maintenance and Systems https://nptel.ac.in

Assessment (Practical course)
Lab Workbook, Exercises and Model Exam

Course Curated by		
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
		Mr. Arun Kumar R, Aeronautical Engineering, KCT
Recommended by BoS on		
Academic Council Approval		**Date**

24AEP310	Aero Modeling and Flight Simulation Laboratory	L	T	P	J	C
		0	0	2	0	1
Practical		SDG	4 & 9			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	To introduce the fundamental components of UAV systems, including airframe, propulsion, flight control systems, and cockpit instrumentation.
2	To provide hands-on experience in basic flight operations such as take-off, maneuvering, and landing using flight simulation tools.
3	To develop the ability to analyze aircraft performance, stability, and control behavior under varying flight and engine conditions.
4	To familiarize students with aircraft avionics and navigation systems, including communication and navigation aids such as COM/NAV, ADF, DME, GPS, and autopilot systems.
5	To enable students to use flight simulation software for mission planning, execution, performance evaluation, and effective technical communication of results.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain the components of UAV systems, flight controls, and cockpit instruments.	Ap
CO2	Demonstrate basic flight operations including take-off, maneuvers, and landing using a flight simulator.	Ap
CO3	Analyze aircraft performance and stability based on control inputs and engine parameters.	An
CO4	Operate aircraft avionics and navigation systems including COM/NAV, ADF, DME, GPS, and autopilot.	Ap
CO5	Apply flight simulation tools to plan, execute, and evaluate mission-based flights, and communicate results effectively.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	2	-	-	-	1	-	1	3	-
2	2	1	-	2	3	-	-	1	2	-	1	2	3
3	3	3	2	3	3	1	-	-	1	-	1	3	3

4	3	2	-	1	3	-	-	-	1	-	1	3	3
5	2	3	2	3	3	1	1	2	3	-	3	3	3

Course Content (Exercises)
1. Familiarization with UAV Components
2. Familiarization with Flight Simulator Controls and Cockpit Layout
3. Basic Aircraft Control and Straight & Level Flight
4. Take-off and Landing Procedures
5. Effect of Control Surfaces and Flight Dynamics
6. Introduction to Avionics and Radio Communication
7. Radio Navigation using NAV, ADF, and DME
8. GPS-Based Navigation and Flight Planning
9. Autopilot Operation and Flight Modes
10. Engine and Flight Performance Analysis

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**30**	**Project Hours:**	**Total Hours:**	**30**

Learning Resources
Textbooks:
1. "Pilot's Handbook of Aeronautical Knowledge", US Department of Transportation, FAA (2023). 2. "Airplane Flying Handbook", US Department of Transportation, FAA (2021).
References:
1. R. P. G. Collinson, "Introduction to Avionics Systems", Fourth Edition, Springer (2023). 2. Tian Seng Ng, "Flight Systems and Control: A Practical Approach", Springer (2018).
Online Educational Resources:
1. https://www.faa.gov/regulations_policies/handbooks_manuals/aviation 2. https://www.faa.gov/training_testing/training 3. https://wiki.flightgear.org/

Assessment (Practical course)
Lab Workbook, Exercises and Model Exam

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr. S. Senthil Kumar, Aeronautical Engineering, KCT	
Recommended by BoS on			
Academic Council Approval		**Date**	

Semester-7

24AEI401	Aircraft Design	L	T	P	J	C
		3	0	2	0	4
Professional Core		SDG	9, 12 & 13			

Pre-requisite courses	24AET306	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	To introduce the principles and workflow of conceptual aircraft design based on mission requirements and configuration selection.
2	To develop the ability to perform preliminary aerodynamic sizing using wing loading and thrust/power loading concepts.
3	To impart knowledge on the design of major aircraft components such as wing, fuselage, and tail.
4	To provide understanding of propulsion selection and performance estimation for various flight conditions.
5	To enable students to integrate structural considerations and stability estimates into a complete aircraft design.
6	To introduce the principles and workflow of conceptual aircraft design based on mission requirements and configuration selection.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply conceptual design principles to develop initial aircraft configurations and three-view drawings.	Ap
CO 2	Analyze wing loading and thrust/power loading to determine optimal aerodynamic design parameters.	An
CO 3	Design aircraft components such as wing, fuselage, and tail based on aerodynamic and geometric considerations	C
CO 4	Evaluate propulsion systems and aircraft performance including take-off, climb, and landing characteristics.	E
CO 5	Develop an integrated aircraft conceptual design incorporating structural layout and stability estimates.	C

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	2	2	-	3	-	-	2	2	-	1	3	1
2	3	3	2	2	3	-	-	2	1	-	1	3	2

3	3	2	3	2	3	-	-	3	2	-	1	3	2
4	3	3	2	2	3	-	-	2	1	-	1	3	2
5	3	3	3	2	3	-	-	3	3	1	2	3	3

Course Content	
Conceptual Aircraft Design Design process – design flow chart – survey of aircraft types – mission requirements – configuration selection – initial sizing – take-off weight estimation – three-view drawing – spreadsheet approach for conceptual design – Introduction to OpenMDAO, SUAVE and OpenVSP. **Practical Component:** • Comparative configuration study of different aircraft • Selection of mission profile and design parameters • Preparation of initial design sheet (spreadsheet) • Parametric conceptual design of a chosen aircraft class using OpenVSP	**9 Hours** **6 Hours**
Preliminary Aerodynamic Design Wing loading selection – thrust/power loading – matching chart – effect of wing loading on performance parameters (take-off, climb, range, endurance) – aerodynamic configuration layout – design point selection. **Practical Component:** • Preparation of matching charts • Wing loading vs thrust/power loading analysis • Selection of design point • Spreadsheet-based aerodynamic sizing	**9 Hours** **6 Hours**
Design of Wing, Fuselage and Tail Wing design – airfoil selection – aspect ratio, taper ratio, sweep – drag estimation – fuselage design and layout – tail volume coefficients – horizontal and vertical tail sizing – aerodynamic considerations. **Practical Component:** • Airfoil selection using tools (XFOIL/airfoil database) • Wing geometry design (span, chord, AR) • Fuselage sizing and layout • Tail sizing using volume coefficient method	**9 Hours** **6 Hours**
Propulsion and Performance Estimation Engine selection – thrust-to-weight ratio – propeller and jet propulsion basics – installed thrust – performance estimation – take-off and landing distance – climb performance – range and endurance – high-lift devices - budget analysis for hybrid-electric variant. **Practical Component:** • Power plant selection based on mission • Performance calculations (take-off, climb, landing)	**9 Hours** **6 Hours**

• Range and endurance estimation • Preparation of performance spreadsheet	
Structural Design and Final Configuration Load estimation – structural layout of wing and fuselage – materials for aircraft structures – control surface sizing – V–n diagram – gust loads – design integration and optimization. **Practical Component:** • V–n diagram and gust envelope construction • Load estimation on wing and fuselage • Stability estimation • Final aircraft design report with CAD model	**9 Hours** **6 Hours**

Theory Hours:45	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:75

Learning Resources

Textbooks:

1. Thomas C. Corke, Design of Aircraft, 1st Edition, Pearson Education, 2003.
2. Daniel P. Raymer, Aircraft Design: A Conceptual Approach, 6th Edition, AIAA Education Series, 2018.
3. John P. Fielding, Introduction to Aircraft Design, 2nd Edition, Cambridge University Press, 2017.
4. Egbert Torenbeek, Synthesis of Subsonic Airplane Design, Reprint Edition, Delft University Press, 2013.
5. Snorri Gudmundsson, General Aviation Aircraft Design: Applied Methods and Procedures, 1st Edition, Butterworth-Heinemann, 2013.

References:

1. Darrol Stinton, The Design of the Aeroplane, 2nd Edition, Blackwell Science, 2001.
2. Jan Roskam, Airplane Design (Part I–VIII), Reprint Edition, DARcorporation, 2003.
3. Daniel P. Raymer, Simplified Aircraft Design for Homebuilders, 1st Edition, AIAA, 2003.
4. Lloyd R. Jenkinson, Paul Simpkin, and Darren Rhodes, Civil Jet Aircraft Design, 1st Edition, Butterworth-Heinemann, 1999.
5. Richard Shevell, Fundamentals of Flight, 2nd Edition, Prentice Hall, 1989 (Reprint).

Online Educational Resources:

1. https://nptel.ac.in/courses/101105084
2. https://ocw.mit.edu/courses/16-885j-aircraft-systems-engineering-fall-2005/
3. https://aa241x.stanford.edu/
4. https://www.grc.nasa.gov/www/k-12/airplane/short.html

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, Report submission (team-based aircraft design project), Project presentation (weekly and final), viva-voce examination, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
			Mr.Muthukumar S /AERO Dr.M. Senthil Kumar/AERO
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AET402	Composite Materials and Structures	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4, 9 & 12			

Pre-requisite courses	24PHT107	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental concepts of composite materials, including matrices and reinforcements.
2	Analyze micromechanical behavior and evaluate properties like volume fraction, density, and void effects.
3	Apply macromechanics and generalized Hooke's law for anisotropic composite materials.
4	Evaluate stress–strain behavior, failure theories, and laminated plate theory of composites.
5	Understand fabrication processes, sandwich structures, and repair techniques used in aerospace composites.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze the types, properties, and applications of composite materials	An
CO 2	Analyze micromechanical and macromechanical behavior of composite materials	An
CO 3	Apply laminated plate theory and stress–strain relations for composite structures	Ap
CO 4	Analyze failure theories, sandwich structures, and interlaminar stresses	An
CO 5	Evaluate fabrication methods, repair techniques, and environmental effects on composites	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	1	2	1	–	–	1	1	–	1	3	2
2	3	3	2	2	2	–	–	1	1	–	1	3	2
3	3	2	1	2	1	–	–	1	1	–	1	3	1
4	3	3	2	2	2	–	–	1	1	–	1	3	2
5	3	2	1	3	3	–	–	3	2	–	1	3	3

Course Content	
MICROMECHANICS Introduction – advantages and application of composite materials – types of reinforcements and matrices – micromechanics – mechanics of materials approach – elasticity approach – fiber volume ratio – mass fraction – density of composites – effect of voids in composites.	**9 Hours**
MACROMECHANICS Generalized Hooke's Law – elastic constants for anisotropic, orthotropic and isotropic materials – macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – experimental characterization of lamina.	**10 Hours**
LAMINATED PLATE THEORY Governing differential equation for a laminate – stress-strain relations for a laminate – different types of laminates – failure theory for composites – interlaminar stresses – netting analysis.	**10 Hours**
SANDWICH CONSTRUCTIONS Basic design concepts of sandwich construction – Materials used for sandwich construction – Failure modes of sandwich panels – Flexural rigidity of Sandwich beams and plates.	**7 Hours**
FABRICATION PROCESS AND REPAIR METHODS Various open and closed mould processes – manufacture of fibers – importance of repair and different types of repair techniques in composites – Manufacture of fibres - Environmental effects on composites.	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. Autar K. Kaw, 'Mechanics of Composite Materials', Second Edition, First Indian Reprint, CRC Press, 2009.
2. Jones, R.M., 'Mechanics of Composite Materials', McGraw-Hill, Kogakusha Ltd., Tokyo, 1999.
3. Lalit Gupta, 'Advanced Composite Materials', Revised Edition, Fourth Reprint, Himalayan Books, 2007

References:

1. Alan Baker, Stuart Dutton, and Donald Kelly, 'Composite Materials for Aircraft Structures', Second Edition, AIAA, 2004.
2. Krishan K. Chawla, 'Composite Materials: Science and Engineering', Third Edition, Springer, 2013.
3. Ever J. Barbero, "Introduction to Composite Materials Design", CRC Press, Second Edition 2010.

Online Educational Resources:

1. https://nptel.ac.in/courses/101104010/
2. http://www.ae.iitkgp.ac.in/ebooks/chapter1.html
3. https://www.youtube.com/watch?v=0kB0G6WKhKE&list=PLSGws_74K01-bdEEUElQ9-obrujIKGEhg

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Mr Suresh Mishra LMW Advanced Technology Centre	Dr. S Venkatachalam Karunya Institute of Technology and Sciences		Mr.Raj Kumar G /AERO Mr R. Arun Kumar/ AERO
Recommended by BoS on			
Academic Council Approval		**Date**	

Professional Electives

24AEC001	Experimental Aerodynamics	L	T	P	J	C
		2	0	1	0	3
Professional Elective		SDG	4 & 9			

Pre-requisite courses	24AEI206, 24AET301	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	To introduce the fundamental principles of experimental methods and measurement techniques in aerodynamics.
2	To develop understanding of wind tunnel testing and force measurement using modern instrumentation.
3	To impart knowledge of flow visualization and analogue methods for aerodynamic studies.
4	To provide exposure to high-speed flow diagnostics and compressible flow experiments.
5	To enable students to acquire, analyze, and interpret experimental data using modern data acquisition systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the principles of aerodynamic measurements, instrumentation, and experimental methods.	U
CO 2	Apply wind tunnel testing techniques to measure aerodynamic forces and flow properties	Ap
CO 3	Analyze flow behavior using visualization techniques and analogue methods.	An
CO 4	Evaluate high-speed flow phenomena using experimental diagnostics such as shadowgraph and shock tube.	E
CO 5	Analyze experimental data and estimate measurement uncertainties using data acquisition systems.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	2		1	1				1		1	3	1
2	3	3	2	2	3			2	1		1	3	3
3	3	2		3	2			2	1		1	3	2
4	3	3		3	2			2	1		1	3	2
5	3	3		3	3			2	1		2	3	3

Course Content	
Fundamentals of Experimental Methods Objective of experimental studies – fluid properties and measurement basics – types of measurements – Direct and analogue methods – flow visualization basics – components of measurement systems – importance of model testing. **Practical Component** • Familiarization with wind tunnel and instruments • Measurement of velocity using Pitot-static tube • Calibration of basic measurement devices	**6 Hours** **3 Hours**
Wind Tunnel Testing and Instrumentation Types of wind tunnels (low speed, supersonic, special tunnels) – performance characteristics – power losses – instrumentation in wind tunnels – force measurement using balances – calibration techniques. **Practical Component:** • Force measurement using strain gauge / load cell • Calibration of load measurement system • Lift/drag estimation on a model	**6 Hours** **3 Hours**
Flow Visualization and Analogue Methods Principles of flow visualization – Hele-Shaw apparatus and analogy to potential flow – interferometer – Schlieren and shadowgraph techniques – hydraulic analogy – electrolytic tank methods. **Practical Component:** • Hele-Shaw experiment • Water channel flow visualization • Smoke Flow visualization over cylinder/airfoil	**6 Hours** **3 Hours**
High-Speed Flow Diagnostics Compressibility effects in experiments – optical diagnostics – Schlieren and shadowgraph principles – shock waves and expansion phenomena – basics of high-speed experimental techniques. **Practical Component:** • High-speed jet with shadowgraph visualization • Shock tube demonstration / experiment • Observation of shock waves and compressibility effects	**6 Hours** **3 Hours**
Advanced Measurements, Data Acquisition and Uncertainty Measurement of pressure, velocity and temperature – pressure transducers – hot-wire anemometry – LDV and PIV (overview) – data acquisition systems – signal conditioning – uncertainty analysis – error estimation. **Practical Component:** • LabVIEW-based data acquisition • Rotary torque sensor experiment • Aeroacoustic measurement • Data processing and uncertainty estimation	**6 Hours** **3 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:15	Project Hours:0	Total Hours:45

Learning Resources

Textbooks:

1. E. Rathakrishnan, Instrumentation, Measurements, and Experiments in Fluids, 2nd Edition, CRC Press, 2016.
2. A. Pope and K. L. Goin, High-Speed Wind Tunnel Testing, Reprint Edition, Krieger Publishing, 2000.
3. J. B. Barlow, W. H. Rae Jr., and A. Pope, Low-Speed Wind Tunnel Testing, 3rd Edition, Wiley, 1999 (Reprint).
4. R. J. Goldstein (Ed.), Fluid Mechanics Measurements, 2nd Edition, Taylor & Francis, 1996 (Reprint).
5. T. J. Mueller (Ed.), Aerodynamic Measurements, 1st Edition, Springer, 2002.

References:

1. M. Gad-el-Hak, Flow Control: Passive, Active, and Reactive Flow Management, 1st Edition, Cambridge University Press, 2000.
2. H. W. Liepmann and A. Roshko, Elements of Gas Dynamics, Reprint Edition, Dover Publications, 2001.
3. J. W. Dally, W. F. Riley, and K. G. McConnell, Instrumentation for Engineering Measurements, 2nd Edition, Wiley, 1993 (Reprint).
4. R. P. Benedict, Fundamentals of Temperature, Pressure, and Flow Measurements, 3rd Edition, Wiley, 1984 (Reprint).
5. A. M. Oppenheim and R. W. Schafer, Discrete-Time Signal Processing, 3rd Edition, Pearson, 2010.

Online Educational Resources:

1. https://nptel.ac.in/courses/112104118
2. https://nptel.ac.in/courses/112105183
3. https://ocw.mit.edu/courses/2-25-advanced-fluid-mechanics-fall-2013/
4. https://www.grc.nasa.gov/www/k-12/airplane/

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, Lab workbook, viva-voce examination, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
	Dr. K Rajasekar Jain University	Mr.Muthukumar S /AERO Dr.M. Senthil Kumar/AERO
Recommended by BoS on		
Academic Council Approval	No.	**Date**

24AEE002	Hypersonic Aerodynamics	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9, 11 & 13			

Pre-requisite courses	24AET301	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	To provide fundamental knowledge of hypersonic flow physics and distinguish hypersonic aerodynamics from supersonic aerodynamics through concepts such as thin shock layers and entropy layers.
2	To develop the ability to apply Newtonian theory, tangent wedge, and other inviscid flow methods for analyzing hypersonic aerodynamic problems.
3	To impart understanding of hypersonic boundary layer behavior, aerodynamic heating phenomena, and thermal effects on aerospace structures.
4	To familiarize students with viscous interaction phenomena in hypersonic flows and their influence on aerodynamic characteristics and vehicle performance.
5	To introduce high-temperature gas dynamics, chemical reactions, dissociation, recombination, and real-gas effects relevant to hypersonic flight applications.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze the differences between hypersonic and supersonic aerodynamics to understand the concepts of thin shock layers and entropy layers.	An
CO 2	Apply the Newtonian theory and tangent wedge methods to solve problems in hypersonic inviscid flows.	Ap
CO 3	Evaluate the boundary layer equations for hypersonic flow to understand aerodynamic heating and its effects on airframes.	E
CO 4	Examine the concept of viscous interactions in hypersonic flows to analyze strong and weak interactions and their impact on flow characteristics.	An
CO 5	Analyze models to predict high temperature effects in hypersonic flows, considering chemical reactions in air and boundary layer recombination and dissociation.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	1	1	1	-	-	-	-	-	1	3	-
2	3	3	2	2	2	-	-	-	-	-	1	3	2
3	3	3	2	2	2	-	-	-	-	-	1	3	-

4	3	3	2	2	2	-	-	-	-	-	1	3	-
5	3	3	2	2	2	-	-	-	-	-	1	3	-

Course Content	
FUNDAMENTALS OF HYPERSONIC AERODYNAMICS Introduction to hypersonic aerodynamics – differences between hypersonic aerodynamics and supersonic aerodynamics - concept of thin shock layers and entropy layers – hypersonic flight paths – hypersonic similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.	**9 hrs**
SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS Local surface inclination methods – Newtonian theory – modified Newtonian law – tangent wedge and tangent cone and shock expansion methods – approximate methods - hypersonic small disturbance theory – thin shock layer theory.	**9 hrs**
VISCOUS HYPERSONIC FLOW THEORY Boundary layer equations for hypersonic flow – hypersonic boundary layers – self similar and non-self-similar boundary layers – solution methods for non-self-similar boundary layers – aerodynamic heating and its adverse effects on airframe.	**9 hrs**
VISCOUS INTERACTIONS IN HYPERSONIC FLOWS Introduction to the concept of viscous interaction in hypersonic flows - Strong and weak viscous interactions - hypersonic viscous interaction similarity parameter – introduction to shock wave boundary layer interactions.	**9 hrs**
HIGH TEMPERATURE EFFECTS IN HYPERSONIC FLOWS Nature of high temperature flows – chemical effects in air – real and perfect gases – Gibb's free energy and entropy - chemically reacting boundary layers – recombination and dissociation.	**9 hrs**

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:**
45				**45**

Learning Resources

Textbooks:

1. John D. Anderson, Jr, 'Hypersonic and High Temperature Gas Dynamics', Second Edition, AIAA Education Series, 2006.
2. John D. Anderson., 'Modern Compressible Flow', Third Edition, Tata McGraw-Hill, New Delhi, 2012.
3. Hayes, W.D, and R.F Probstein, 'Hypersonic Flow Theory', Second Edition, Academic Press, New York, 1966.

References:

1. John D Anderson, Jr., 'Fundamentals of Aerodynamics', Chapter 14, Sixth Edition, McGraw-Hill Education, 2016.
2. Vinh, N.X, A. Busemann, and R. D Culp, 'Hypersonic and Planetary Entry Flight Mechanics', University of Michigan Press, Ann Arbor, 1980.

Online Educational Resources:
1. https://nptel.ac.in/courses/101103003/ 2. https://www.grc.nasa.gov/www/BGH/index.html 3. https://www.aem.umn.edu/teaching/curriculum/syllabi/Grad/AEM_5245_syllabus.shtml 4. https://web.stanford.edu/~jurzay/ME356/ 5. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2005/video-lectures/lecture-7/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr. M Senthil Kumar	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE003	Helicopter Aerodynamics	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9, 11 & 13			

Pre-requisite courses	24AEI206	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	To provide fundamental knowledge of helicopter configurations, rotor systems, and control mechanisms involved in rotary wing flight.
2	To develop the ability to analyze hovering performance using momentum theory and blade element theory for estimating induced and profile power.
3	To impart understanding of helicopter forward flight characteristics, power requirements, performance analysis, and stability aspects.
4	To familiarize students with the operating principles and performance characteristics of various V/STOL aircraft configurations.
5	To introduce lift augmentation techniques and ground effect machine concepts for improving hover performance and power efficiency.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze the configurations and control methods of helicopters to understand torque reaction and control mechanisms.	An
CO 2	Evaluate the hovering performance using momentum and blade element theories to estimate profile and induced power.	E
CO 3	Calculate the power requirements for forward flight to generate performance curves and assess helicopter stability.	Ap
CO 4	Compare various configurations of V/STOL aircraft to evaluate their performance in different flight modes.	An
CO 5	Evaluate lift augmentation systems for ground effect machines to optimize hover height and power efficiency.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	1	1	-	-	-	-	-	-	1	3	-
2	3	3	2	2	-	-	-	-	-	-	1	3	-
3	3	3	2	2	-	-	-	-	-	-	1	3	-
4	3	3	2	2	-	-	-	-	-	-	1	3	-
5	3	3	2	2	-	-	-	-	-	-	1	3	-

Course Content	
ELEMENTS OF HELICOPTER AERODYNAMICS Configurations based on torque reaction – Jet rotors and compound helicopters – Methods of control – Collective and cyclic pitch changes – Lead-Lag and flapping hinges.	**10 hrs**
IDEAL ROTOR THEORY Hovering performance – Momentum and simple blade element theories – Figure of merit – Profile and induced power estimation – Constant chord and ideal twist rotors.	**12 hrs**
POWER ESTIMATION Induced, profile and parasite power requirements in forward flight – Performance curves with effects of altitude – Preliminary ideas on helicopter stability.	**8 hrs**
LIFT, PROPULSION AND CONTROL OF V/STOL AIRCRAFT Various configuration – Propeller, rotor, ducted fan and jet lift – Tilt wing and vectored thrust – Performance of VTOL and STOL aircraft in hover, transition and forward motion.	**8 hrs**
GROUND EFFECT MACHINES Types – Hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machine – Drag of hovercraft on land and water – Applications of hovercraft.	**7 hrs**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**		**Project Hours:**		**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Gessow A and Myers G.C., 'Aerodynamics of the Helicopter', Continuum International Publishing Group Ltd., 1997.
2. Gupta. L, 'Helicopter Engineering', Himalayan Books, 1996.
3. John M. Seddon and Simon Newman, 'Basic Helicopter Aerodynamics', Third Edition, AIAA Education Series, 2011.
4. J. Gordon Leishman, 'Principles of Helicopter Aerodynamics', Second Edition, Cambridge University Press, 2006.
5. Barnes W. McCormick, 'Aerodynamics of V/STOL Flight', Academic Press Inc., 1967.

References:

1. Simon Newman, 'The Foundations of Helicopter Flight', Halsted Press, 1994.
2. Philip Terpstra, 'V/STOL Aircraft Design', Third Edition, Spirit Publications, 2005.
3. Barnes W. McCormick, 'Aerodynamics, Aeronautics and Flight Mechanics', Second Edition, Wiley India Pvt. Ltd., 2009.

Online Educational Resources:

1. https://nptel.ac.in/courses/101104017

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-			Dr. M Senthil Kumar
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE004	Industrial Aerodynamics	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9, 11 & 13			

Pre-requisite courses	24AEI206	Data Book / Code book (If any)	

Course Objectives:

The purpose of taking this course is to:

1	To introduce the principles of industrial aerodynamics and their applications in engineering systems such as vehicles and structures.
2	To develop understanding of external flows over bluff bodies and their aerodynamic characteristics.
3	To impart knowledge of wind engineering and its effects on buildings and environmental flows.
4	To provide understanding of internal flows in ducts, pipes, and industrial systems.
5	To introduce concepts of aeroacoustics and flow-induced noise and their control methods.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamental principles of industrial aerodynamics and flow behavior over engineering systems.	U
CO 2	Analyze external flows over bluff bodies including drag, vortex shedding, and flow-induced effects.	An
CO 3	Evaluate wind effects on buildings and environmental flows in practical scenarios.	E
CO 4	Apply principles of internal flow to analyze industrial systems such as ducts and ventilation systems.	Ap
CO 5	Analyze aerodynamic noise generation and suggest methods for noise control in engineering applications.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	-	-	-	1	-	1	3	1
2	3	3	2	2	1	-	-	-	1	-	1	3	1
3	3	2	2	2	1	2	2	-	1	-	1	3	1
4	3	3	2	2	2	-	-	-	1	-	1	3	2
5	3	2	2	2	1	2	2	-	1	-	2	3	1

Course Content	
Fundamentals of Industrial Aerodynamics Introduction to industrial aerodynamics – applications in engineering systems – fluid properties and flow regimes – boundary layer concepts – laminar and turbulent flows – flow separation and reattachment – drag and lift forces – dimensional analysis and similarity – Reynolds number effects in industrial flows.	**9 hrs**
External Flows and Bluff Body Aerodynamics Flow over bluff bodies – wake formation and vortex shedding – drag on cylinders, spheres and vehicles – flow-induced vibrations – Strouhal number – aerodynamic forces on structures – applications in automobiles and structures.	**9 hrs**
Wind Engineering and Building Aerodynamics Atmospheric boundary layer – wind characteristics and turbulence – wind loads on buildings and structures – pressure distribution on tall buildings – interference effects – wind tunnel testing for civil structures – ventilation and pollutant dispersion – pedestrian-level wind environment.	**9 hrs**
Internal Flows and Industrial Systems Flow in ducts, pipes and diffusers – losses in internal flows – flow through valves, bends and fittings – fans, blowers and compressors – heat transfer considerations – aerodynamic design of HVAC systems – industrial ventilation systems.	**9 hrs**
Aeroacoustics and Flow-Induced Noise Sources of aerodynamic noise – vortex shedding noise – jet noise – fan and compressor noise – noise measurement techniques – basic acoustic theory – noise control methods – industrial noise reduction strategies – environmental considerations.	**9 hrs**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:** 45

Learning Resources

Textbooks:

1. Wolf-Heinrich Hucho, Fundamentals of Vehicle Aerodynamics, 4th Edition, Butterworth-Heinemann, 1998 (Reprint).
2. Wolf-Heinrich Hucho, Aerodynamics of Road Vehicles, 5th Edition, SAE International, 2013.
3. Emil Simiu and Robert H. Scanlan, Wind Effects on Structures, 3rd Edition, Wiley, 1996 (Reprint).
4. Hermann Schlichting and Klaus Gersten, Boundary-Layer Theory, 9th Edition, Springer, 2017.
5. Frank M. White, Fluid Mechanics, 8th Edition, McGraw-Hill, 2016.

References:

1. Aerodynamics of Vehicles, 1st Edition, Springer, 2016.
2. Wind Engineering, Reprint Edition, Elsevier.
3. Low-Speed Wind Tunnel Testing, 3rd Edition, Wiley, 1999.
4. Introduction to Boundary Layer Meteorology, 1st Edition, Springer, 1988 (Reprint).
5. Flow-Induced Vibration, 2nd Edition, Krieger Publishing, 2001.

Online Educational Resources:
1. https://nptel.ac.in/courses/105107121 2. https://nptel.ac.in/courses/112105183 3. https://ocw.mit.edu/courses/2-25-advanced-fluid-mechanics-fall-2013/ 4. https://www.grc.nasa.gov/www/k-12/airplane/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-			Mr. Muthukumar S
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEC005	Computational Methods for Aerospace Analysis	L	T	P	J	C
		2	0	2	0	3
Professional Elective		SDG	4, 9 & 13			

Pre-requisite courses	24AEI303	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand advanced mesh generation techniques, mesh quality metrics, and their influence on CFD solution accuracy for aerospace geometries.
2	Apply higher-order discretisation schemes and boundary condition formulations to aerospace CFD problems.
3	Understand scale-resolving turbulence approaches and their selection criteria for unsteady aerospace flows.
4	Simulate rotating and moving aerospace configurations using sliding mesh and dynamic mesh methods.
5	Apply CFD post-processing, force integration, error analysis, and solution validation techniques for aerospace applications.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Generate structured, unstructured, and hybrid meshes for aerospace geometries and evaluate their quality metrics.	Ap
CO 2	Select and apply appropriate numerical schemes and boundary condition types for aerospace CFD problem setup.	Ap
CO 3	Identify suitable scale-resolving turbulence models for unsteady and separated aerospace flows and justify their selection.	An
CO 4	Set up and execute sliding mesh and dynamic mesh simulations for rotating and moving aerospace configurations.	An
CO 5	Perform CFD post-processing, integrate aerodynamic forces, identify error sources, and validate results against reference data.	E

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	3	2	2	1	-	-	1	1	-	1	3	2

2	3	3	2	2	2	-	-	1	1	-	1	3	2
3	3	3	2	3	2	-	-	1	1	-	1	3	2
4	3	3	3	3	2	-	-	2	2	-	1	3	2
5	2	3	2	3	3	-	-	2	2	-	2	3	3

Course Content

ADVANCED MESH GENERATION AND QUALITY ASSESSMENT Structured, unstructured, and hybrid meshing strategies — O-grid, C-grid, H-grid topologies, tetrahedral and mixed element generation for complex aerospace geometries — mesh quality metrics: skewness, orthogonal quality, aspect ratio, and growth rate – Boundary layer mesh design — first cell height, inflation layer setup, y+ requirements, and their combined influence on CFD solution accuracy.	**6 Hours**
Practical Component: Experiment 1: Structured and Unstructured Mesh Generation for a Lifting Surface and Mesh Quality Assessment (ANSYS Meshing). Experiment 2: Boundary Layer Mesh Design and y+ Sensitivity Study for an External Aerodynamic Configuration (ANSYS Fluent 23).	**6 Hours**
NUMERICAL SCHEMES AND BOUNDARY CONDITION FORMULATIONS Convection discretisation schemes — first-order upwind, second-order upwind, QUICK, and bounded central differencing: formulation, numerical diffusion, and selection criteria for aerospace flow problems – Boundary condition types — inlet formulations: velocity inlet, pressure inlet, and mass flow inlet; outlet, wall, symmetry, and far-field boundary conditions: physical interpretation and appropriate selection for external and internal aerospace flow problems.	**6 Hours**
Practical Component: Experiment 3: Numerical Scheme Sensitivity Study on Aerodynamic Coefficient Prediction for a Lifting Surface (ANSYS Fluent 23). Experiment 4: Boundary Condition Formulation and Its Influence on External Aerodynamic Flow Simulation (ANSYS Fluent 23).	**6 Hours**
SCALE-RESOLVING TURBULENCE MODELS FOR UNSTEADY FLOWS Limitations of RANS models for separated and unsteady flows — Large Eddy Simulation: spatial filtering concept and sub-grid scale modelling — motivation and transition to scale-resolving approaches – Detached Eddy Simulation and Delayed Detached Eddy Simulation: hybrid RANS-LES formulation, switching function, shielding function, selection criteria, and computational cost comparison for aerospace flow problems.	**6 Hours**
Practical Component: Experiment 5: Detached Eddy Simulation of Unsteady Separated Flow over an Aerial Configuration at High Angle of Attack (ANSYS Fluent 23). Experiment 6: Comparative Aerodynamic Load Prediction using RANS and Detached Eddy Simulation Approaches (ANSYS Fluent 23).	**6 Hours**
SLIDING MESH AND DYNAMIC MESH METHODS Sliding mesh method — concept, interface formulation, flux conservation across sliding interfaces, and comparison with Moving Reference Frame for rotating aerospace configurations – Dynamic mesh methods — spring-based smoothing, local remeshing, and layering: mesh motion definition, time step selection, and interface resolution requirements for moving aerospace configurations.	**6 Hours**

Practical Component: Experiment 7: Sliding Mesh Simulation of a Rotating Aerial System and Aerodynamic Performance Evaluation (ANSYS Fluent 23). Experiment 8: Dynamic Mesh Simulation of a Moving Control Surface and Unsteady Aerodynamic Load Prediction (ANSYS Fluent 23).	**6 Hours**
CFD POST-PROCESSING, ERROR ANALYSIS, AND SOLUTION VALIDATION Surface pressure coefficient, wall shear stress extraction, aerodynamic force and moment integration, and flow visualisation techniques — streamlines, velocity vectors, contour plots, and iso-surfaces – Numerical error sources in CFD: discretisation error, iterative convergence error, and modelling error — Verification and Validation methodology, procedure, and validation of CFD results against experimental and published reference data.	**6 Hours**
Practical Component: Experiment 9: Aerodynamic Force and Moment Integration and Flow Visualisation for an External Aerodynamic Configuration (ANSYS Fluent 23). Experiment 10: CFD Solution Verification and Validation of an Aerospace Flow Problem against Experimental Reference Data (ANSYS Fluent 23).	**6 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60

Learning Resources

Textbooks:

1. J. H. Ferziger, M. Peric and R. L. Street, Computational Methods for Fluid Dynamics, 4th Ed., Springer, 2020.
2. J. D. Anderson Jr., Computational Fluid Dynamics — The Basics with Applications, McGraw-Hill, 1995.
3. H. K. Versteeg and W. Malalasekera, An Introduction to Computational Fluid Dynamics – The Finite Volume Method, 2nd Ed., Pearson, 2007.

References:

1. P. Sagaut, Large Eddy Simulation for Incompressible Flows, 3rd Ed., Springer, 2006.
2. D. C. Wilcox, Turbulence Modelling for CFD, 3rd Ed., DCW Industries, 2006.
3. C. Hirsch, Numerical Computation of Internal and External Flows, 2nd Ed., Wiley, 2007.
4. ANSYS Fluent Theory Guide and User's Guide, ANSYS Inc., 2023.

Online Educational Resources:

1. https://nptel.ac.in/courses/101103004/
2. https://innovationspace.ansys.com
3. https://confluence.cornell.edu/display/SIMULATION/FLUENT+Learning+Modules
4. https://ocw.mit.edu/courses/16-90-computational-methods-in-aerospace-engineering-spring-2014/

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Mr.R. Vijayanandh /AERO
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE006	Rockets and Missiles	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4			

Pre-requisite courses	24AEI206 & 24AET306	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamentals of rocket propulsion and missile systems.
2	To understand the aerodynamics and flight mechanics of rockets and missiles.
3	To analyze rocket motion using 3-DOF and 6-DOF models.
4	To study guidance, navigation, and control mechanisms.
5	To familiarize students with design considerations and mission requirements

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain principles of rocket propulsion and classify propulsion systems.	U
CO 2	Analyze aerodynamic forces acting on rockets and missiles.	An
CO 3	Apply equations of motion for trajectory prediction (3-DOF & 6-DOF).	Ap
CO 4	Describe guidance, navigation, and control systems.	U
CO 5	Evaluate design and performance of rocket and missile systems.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	-	-	-	-	-	2	3	-
2	3	3	-	2	-	-	-	-	-	-	2	3	-
3	3	3	2	3	3	-	-	-	-	-	2	3	3
4	2	3	3	2	3	-	2	2	2	-	2	3	2
5	3	3	3	3	3	2	2	2	2	2	3	3	3

Course Content

INTRODUCTION TO ROCKETS AND MISSILES	7 Hours
History and evolution of rockets and missiles; Classification: ballistic, cruise missiles, sounding rockets; Rocket subsystems and mission profiles; Rocket equation and performance parameters.	

ROCKET PROPULSION Fundamentals of propulsion; Solid, liquid, and hybrid propulsion systems; Thrust equation and specific impulse; Nozzle flow and expansion; Multistaging.	**6 Hours**
AERODYNAMICS OF ROCKETS AND MISSILES Aerodynamic forces and moments; Supersonic and hypersonic flow basics; Stability and control derivatives; Drag and lift estimation; Effect of fins and configuration.	**8 Hours**
FLIGHT MECHANICS AND EQUATIONS OF MOTION Coordinate systems (inertial, body, Earth-fixed frames); 6-DOF Equations of Motion; Translational Dynamics (Body Frame); Rotational Dynamics; Kinematics (Euler Angles); Ballistic and gravity turn trajectories; Introduction to re-entry dynamics; Coupled translational–rotational motion; Stability considerations in 6-DOF motion.	**12 Hours**
GUIDANCE, NAVIGATION, AND CONTROL Guidance laws: proportional navigation; Navigation systems: INS, GPS; Control systems: actuators and autopilot; Stability augmentation; Missile interception and tracking; System-level integration.	**12 Hours**

Theory	**Tutorial**	**Practical**	**Project**	**Total**
Hours: 45	**Hours: 0**	**Hours: 0**	**Hours: 0**	**Hours: 45**

Learning Resources

Textbooks

1. George P. Sutton, Oscar Biblarz, James H. Morehart, Rocket Propulsion Elements, 10th Edition, Wiley, New York (2026).
2. Eugene L. Fleeman, Tactical Missile Design, AIAA, Inc. (2001).
3. Rafael Yanushevsky, Modern Missile Guidance, 2nd Edition, CRC Press (2019).

References

1. Bong Wie, Space Vehicle Dynamics and Control, 2nd Edition, AIAA, Inc. (2008).
2. John D. Anderson Jr and Mary L. Bowden, Introduction to Flight, 9th Edition, McGraw Hill (2022).
3. Roger R. Bate, Donald D. Mueller, Jerry E. White, and William W. Saylor, Fundamentals of Astrodynamics, 2nd Edition, Dover Publications Inc. (2020).
4. George M. Siouris, Missile Guidance and Control Systems, Springer-Verlag (2004).

Online Educational Resources:

1. https://ocw.mit.edu/courses/16-512-rocket-propulsion-fall-2005/
2. https://nptel.ac.in/courses/101106082
3. https://onlinecourses.nptel.ac.in/noc26_ae07/preview

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE007	Heat and Mass Transfer	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	7, 9 & 13			

Pre-requisite courses	24AEI201, 24AEI202	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand heat and mass transfer mechanisms in aerospace systems.
2	Analyze conduction, convection, and radiation processes.
3	Apply similarity and dimensional analysis techniques.
4	Develop heat exchanger and thermal system solutions.
5	Examine coupled heat and mass transfer phenomena.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain conduction, convection, and radiation principles as applied to aerospace materials and systems.	U
CO2	Analyze one-dimensional and transient heat conduction problems using analytical and numerical methods.	An
CO3	Examine convection heat transfer over surfaces and internal flows	An
CO4	Apply heat exchanger design methods for thermal systems	Ap
CO5	Interpret diffusion and mass transfer mechanisms and their coupling with thermal systems.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	-	2	1
2	3	3	2	2	2	-	-	-	-	-	-	3	2
3	3	3	2	2	2	-	-	-	-	-	-	3	2
4	3	3	3	2	3	-	-	-	-	-	-	3	3
5	3	3	2	3	2	-	2	-	-	-	2	3	2

Course Content	
INTRODUCTION TO HEAT TRANSFER Modes of heat transfer – conduction, convection, radiation – aerospace relevance – steady-state one-dimensional heat conduction in plane and cylindrical walls – thermal conductivity of aerospace alloys and composites – thermal contact resistance – critical thickness of insulation – applications in leading edges and fuel tanks.	**9 Hours**
TRANSIENT AND MULTIDIMENSIONAL CONDUCTION Transient conduction – lumped heat-capacity analysis – Biot and Fourier numbers – semi-infinite solids – use of Heisler charts – two-dimensional steady conduction – numerical solutions by finite-difference method – case studies on turbine blades and satellite structures.	**9 Hours**
CONVECTION HEAT TRANSFER Boundary-layer concepts – dimensional analysis – forced and natural convection correlations – flow over flat plates, cylinders, and spheres – internal flow in tubes – turbulent flow heat transfer – empirical correlations (Dittus–Boelter, Colburn analogy) – aerospace coolant flow management.	**9 Hours**
RADIATION HEAT TRANSFER AND HEAT EXCHANGERS Radiation fundamentals – black-body, gray-body – view factor relations – radiation shields and spacecraft thermal control – heat exchangers: classifications – overall heat-transfer coefficient – LMTD and NTU methods – compact and finned exchangers – applications in gas-turbine cooling and environmental control systems.	**9 Hours**
MASS TRANSFER AND COUPLED HEAT–MASS SYSTEMS Molecular diffusion in gases and liquids – Fick's law – mass-transfer coefficient – analogies between heat, mass, and momentum transfer – evaporation and condensation – combined heat- and mass-transfer in combustion chambers and cryogenic storage – film-wise and drop-wise condensation in aerospace systems.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Holman J.P., Heat Transfer, 11th ed., McGraw-Hill, 2019.
2. Incropera F.P., DeWitt D.P., et al., Fundamentals of Heat and Mass Transfer, Wiley, 2020.
3. Yunus A. Cengel, Heat and Mass Transfer – A Practical Approach, McGraw-Hill, 2018.

References:

1. Kreith F. & Bohn M.S., Principles of Heat Transfer, Cengage, 2016.
2. Srinivasan J., Engineering Heat Transfer, Tata McGraw-Hill, 2017.
3. R.K. Rajput, Heat and Mass Transfer, S. Chand & Co., 2019.

Online Educational Resources:

1. https://nptel.ac.in/courses/112101097
2. https://ocw.mit.edu/courses/2-51-intermediate-heat-and-mass-transfer-fall-2008/

3. https://ocw.tudelft.nl/courses/fluid-flow-heat-mass-transfer/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. S. Narayanan, Propulsion & Thermal Systems Engineer, ISRO HQ	Dr. T. Srinivasan, IIT Madras		Dr. R. Arulprakash, AERO
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE008	Cryogenic Engineering	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	7, 9 & 13			

Pre-requisite courses	24AEI201	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand cryogenic principles and fluid properties.
2	Analyze liquefaction and refrigeration cycles.
3	Design cryogenic storage and insulation systems.
4	Evaluate material behavior at low temperatures.
5	Apply cryogenic systems in aerospace propulsion.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain the principles and applications of cryogenic engineering in aerospace systems	U
CO2	Analyze thermodynamic behavior of cryogenic fluids and liquefaction cycles	An
CO3	Apply cryogenic refrigeration and storage system concepts	Ap
CO4	Examine material and insulation performance at cryogenic temperatures	An
CO5	Implement cryogenic concepts in rocket propulsion and space systems	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	-	2	1
2	3	3	2	2	2	-	-	-	-	-	-	3	2
3	3	3	3	2	3	-	-	-	-	-	-	3	3
4	3	2	2	2	2	-	2	-	-	-	-	3	2
5	3	3	2	2	2	1	2	-	-	-	2	3	2

Course Content

INTRODUCTION TO CRYOGENICS	**9 Hours**
Definition and scope of cryogenics – cryogenic temperature ranges – applications in aerospace, defence, and energy sectors – historical developments – properties	

of cryogenic fluids (hydrogen, helium, nitrogen, oxygen, methane) – comparison with conventional fluids – thermodynamic considerations.	
PRODUCTION AND LIQUEFACTION OF CRYOGENIC FLUIDS Principles of gas liquefaction – Joule–Thomson effect – Linde and Claude systems – Helium and Hydrogen liquefaction – regenerative and cascade cycles – pre-cooling and expansion processes – turbo-expander systems – cryogenic distillation and purification methods.	**9 Hours**
CRYOGENIC REFRIGERATION SYSTEMS Cryogenic refrigeration principles – refrigeration cycles (Stirling, Gifford–McMahon, Pulse Tube) – cryocoolers for spacecraft – design and analysis of cryogenic heat exchangers – efficiency, losses, and optimization – integration with satellite payload and instrumentation systems.	**9 Hours**
CRYOGENIC STORAGE, TRANSFER, AND INSULATION Cryogenic storage vessels – Dewar flasks – design of cryogenic tanks for rocket propellants – heat in-leak and boil-off losses – cryogenic insulation: vacuum insulation, multi-layer, perlite, and foam types – transfer lines, valves, and joints – safety and handling of cryogenic fluids	**9 Hours**
APPLICATIONS IN AEROSPACE SYSTEMS Cryogenic propellants – liquid hydrogen–oxygen engines – storage and feeding systems – regenerative cooling – cryogenic rocket engine cycle (expander, staged combustion) – cryogenic air separation – superconductivity, magnet systems, and advanced cryogenic technologies for space exploration.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Barron R.F., Cryogenic Systems, 2nd Ed., Oxford University Press, 2019.
2. Randall F. Barron, Cryogenic Engineering, McGraw-Hill, 2017.
3. Timmerhaus K.D. & Flynn T.M., Cryogenic Process Engineering, Springer, 2019.

References:

1. Haselden G.G., Cryogenic Fundamentals, Academic Press, 2018.
2. Hands B.A., Cryogenic Engineering, Academic Press, 2017.
3. Valenti M., Cryogenic Rocket Propulsion Systems, Elsevier, 2020.

Online Educational Resources:

1. https://nptel.ac.in/courses/112101004
2. https://trc.nist.gov/cryogenics/
3. https://uspas.fnal.gov/materials/10MIT/MIT-Cryo-Eng.shtml

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. G. Krishnan, Cryogenic Systems Division, ISRO Propulsion Complex	Dr. K. Rajagopal, IIT Madras		Dr. R. Arulprakash, AERO
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE009	Combustion Techniques	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	7, 9 & 13			

Pre-requisite courses	24AEI201 & 24AEI202	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand combustion fundamentals, thermochemistry, and reaction kinetics relevant to aerospace propulsion.
2	Analyze premixed and diffusion flame behavior in gas turbine and rocket engines.
3	Evaluate combustion performance, instabilities, and emission characteristics.
4	Apply experimental and computational diagnostic techniques in combustion analysis.
5	Understand combustion fundamentals, thermochemistry, and reaction kinetics relevant to aerospace propulsion.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain combustion fundamentals, thermochemistry, and reaction kinetics	U
CO2	Analyze premixed and diffusion flame structures and burning velocity	An
CO3	Examine combustion performance and emission characteristics	An
CO4	Apply diagnostic techniques for flame visualization and species measurement	Ap
CO5	Assess advanced and low-emission combustion systems	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	-	2	1
2	3	3	2	2	2	-	-	-	-	-	-	3	2
3	3	3	2	2	2	-	2	-	-	-	-	3	2
4	3	2	2	3	3	-	-	-	-	-	-	2	3
5	3	3	2	2	2	1	2	-	-	-	2	3	2

Course Content	
FUNDAMENTALS OF COMBUSTION Introduction – types of combustion – stoichiometry, equivalence ratio, adiabatic flame temperature – enthalpy of formation and reaction – chemical equilibrium and dissociation – reaction rates and Arrhenius law – chain reactions and ignition phenomena – applications in gas turbine and rocket combustion	**9 Hours**
PREMIXED AND DIFFUSION FLAMES Premixed flame: laminar burning velocity, flame structure, flame stability, flammability limits, quenching – turbulent premixed flames – diffusion flames: laminar jet diffusion flames, droplet combustion, spray combustion – flame propagation and stabilization mechanisms in combustors.	**9 Hours**
COMBUSTION IN AEROSPACE ENGINES Combustion chamber design considerations – pressure loss, mixing efficiency – combustion instabilities and control methods – pollutants: NOx, CO, unburnt hydrocarbons – emission control strategies – combustion in gas turbine and rocket engines – afterburners, ramjets, and scramjets.	**9 Hours**
COMBUSTION DIAGNOSTICS AND INSTRUMENTATION Measurement of temperature, pressure, and species concentration – thermocouples, gas analyzers, and laser-based techniques (LIF, LDV, PIV) – optical diagnostics – flame visualization – emission spectroscopy – introduction to computational combustion and CFD modeling of combustion chambers.	**9 Hours**
ADVANCED AND SUSTAINABLE COMBUSTION SYSTEMS Lean premixed and staged combustion – low-NOx technologies – catalytic combustion – plasma-assisted combustion – micro- and mesoscale combustion – hybrid rocket combustion – alternative fuels (biofuels, hydrogen, synthetic fuels) – green propulsion systems.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources
Textbooks:
1. Turns, S.R., An Introduction to Combustion: Concepts and Applications, McGraw-Hill, 2018. 2. Kuo, K.K., Principles of Combustion, Wiley, 2019. 3. Glassman, I., Yetter, R.A., & Glumac, N., Combustion, Academic Press, 2015.
References:
1. Lefebvre, A.H., Gas Turbine Combustion, CRC Press, 2017. 2. Mattingly, J.D., Elements of Propulsion: Gas Turbines and Rockets, AIAA, 2018. 3. Warnatz, J. et al., Combustion: Physical and Chemical Fundamentals, Modeling and Simulation, Springer, 2019.
Online Educational Resources:
1. https://nptel.ac.in/courses/101104014

2. https://onlinecourses.nptel.ac.in/noc23_me27/preview
3. https://ocw.mit.edu/courses/2-61-internal-combustion-engines-spring-2017/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
- Dr. S. Ramesh, Scientist, Propulsion Research Complex, ISRO	Dr. K.K. Kannan, IIT Madras	Dr. R. Arulprakash, AERO	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE010	Advanced Propulsion Systems	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	7, 9 & 13			

Pre-requisite courses	24AEI408	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Provide an in-depth understanding of advanced air-breathing and non-air-breathing propulsion systems.
2	Analyze the performance and limitations of turbojet, turbofan, ramjet, and scramjet systems.
3	Study the design and operation of rocket engines and advanced propulsion concepts.
4	Explore electric, nuclear, and hybrid propulsion technologies for future aerospace missions.
5	Evaluate the environmental and sustainability aspects of next-generation propulsion systems.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain the principles of advanced air-breathing and rocket propulsion systems	U
CO2	Analyze thermodynamic cycles and performance of propulsion systems	An
CO3	Examine design features and combustion processes of advanced rocket systems	An
CO4	Apply alternative and electric propulsion principles in aerospace systems	Ap
CO5	Assess environmental and sustainability impacts of propulsion technologies	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	-	2	1
2	3	3	2	2	2	-	-	-	-	-	-	3	2
3	3	3	2	2	2	-	-	-	-	-	-	3	2
4	3	2	2	2	3	-	-	-	-	-	-	2	3
5	3	3	2	2	2	1	2	-	-	-	2	3	2

Course Content	
OVERVIEW OF PROPULSION SYSTEMS Review of basic propulsion principles – classification: air-breathing and non-air-breathing engines – performance parameters (thrust, SFC, efficiency) – propulsion trends – advanced cycle analysis – comparison between turbojet, turbofan, turboprop, and ramjet engines – application domains.	**9 Hours**
ADVANCED AIR-BREATHING ENGINES Turbofan and mixed-flow turbofan engines – bypass ratio and fan design – variable cycle engines – afterburners and thrust augmentation – ramjet, scramjet, and dual-mode engines – supersonic combustion principles – hypersonic propulsion and thermal management – challenges in Mach 5+ flight.	**9 Hours**
ADVANCED ROCKET PROPULSION SYSTEMS Chemical rocket propulsion: liquid, solid, and hybrid engines – performance optimization – thrust chamber cooling and expansion systems – cryogenic propulsion – reusable rocket technologies (Raptor, Vulcain, CE20) – nuclear thermal propulsion – challenges in human space missions.	**9 Hours**
ELECTRIC AND ALTERNATIVE PROPULSION Principles of electric propulsion – ion thrusters, Hall effect thrusters, MPD (magnetoplasmadynamic) thrusters – solar sail propulsion – laser-assisted propulsion – hybrid propulsion systems – solar electric propulsion and deep-space applications – energy storage and management systems.	**9 Hours**
EMERGING AND SUSTAINABLE PROPULSION TECHNOLOGIES Green propulsion concepts – biofuels, hydrogen, and synthetic fuels – hybrid-electric propulsion – distributed propulsion systems – boundary-layer ingestion propulsion – propulsion noise reduction – environmental impact and carbon-neutral strategies – future trends and research outlook.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:** 45

Learning Resources

Textbooks:

1. Hill, P.G., & Peterson, C.R., Mechanics and Thermodynamics of Propulsion, Pearson, 2019.
2. Mattingly, J.D., Elements of Propulsion: Gas Turbines and Rockets, AIAA, 2018.
3. Sutton, G.P. & Biblarz, O., Rocket Propulsion Elements, 9th Ed., Wiley, 2017.

References:

1. Heiser, W.H. & Pratt, D.T., Hypersonic Airbreathing Propulsion, AIAA, 2016.
2. Kuo, K.K. & Acharya, R., Fundamentals of Hybrid Rocket Combustion and Propulsion, AIAA, 2018.
3. Anderson, J.D., Hypersonic and High Temperature Gas Dynamics, AIAA, 2020.

Online Educational Resources:

1. https://ocw.mit.edu/courses/16-522-space-propulsion-spring-2015/
2. https://nptel.ac.in/courses/101106082

3. https://eaglepubs.erau.edu/introductiontoaerospaceflightvehicles/chapter/introduction-to-propulsion-systems/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Dr. V. Jayaram, ISRO Propulsion Complex	Dr. S. Natarajan, IIT Madras	Dr. R. Arulprakash, AERO	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE011	Turbomachines	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	7, 9 & 13			

Pre-requisite courses	24AEI201 & 24AEI202	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Introduce the fundamental principles governing energy transfer in turbomachines.
2	Classify and analyze the performance characteristics of turbines, compressors, and pumps.
3	Study the aerodynamic and thermodynamic behavior of axial and radial flow machines.
4	Develop the capability to design turbomachine stages for aerospace and power applications.
5	Explore advances in gas turbine and compressor technologies for sustainable propulsion systems.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain energy conversion principles in turbomachines	U
CO2	Analyze velocity triangles and energy transfer in flow machines	An
CO3	Examine performance characteristics of turbines, compressors, and pumps	An
CO4	Apply turbomachine stage design considering losses and efficiencies	Ap
CO5	Assess modern turbomachinery trends in aerospace and energy systems	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	-	-	-	-	-	-	-	2	1
2	3	3	2	2	2	-	-	-	-	-	-	3	2
3	3	3	2	2	2	-	-	-	-	-	-	3	2
4	3	3	3	2	3	-	-	-	-	-	-	3	3
5	3	3	2	2	2	1	2	-	-	-	2	3	2

Course Content

FUNDAMENTALS OF TURBOMACHINERY Energy transfer in turbomachines – classification and applications – Euler's turbomachine equation – concept of head, work, and efficiencies – dimensionless parameters (flow, head, specific speed) – scaling laws – comparison of turbines, compressors, and pumps	**09 Hours**

AXIAL FLOW TURBINES Principles of axial flow turbines – stage efficiency and degree of reaction – velocity triangles and energy transfer – losses and performance characteristics – multi-stage turbines – design considerations for turbine blades – cooling and materials for high-temperature applications – case study: aircraft gas turbine turbines.	**09 Hours**
AXIAL FLOW COMPRESSORS Working principles – stage velocity triangles – work and efficiency – cascade theory and performance parameters – stalling and surging – compressor matching with turbine – performance maps – variable geometry compressors – application in jet engines and superchargers.	**09 Hours**
RADIAL FLOW MACHINES Centrifugal compressors and radial turbines – energy transfer and efficiency – impeller and diffuser design – slip factor and losses – velocity diagrams – comparison with axial flow machines – mixed-flow configurations – applications in small turbojets and auxiliary power units.	**09 Hours**
ADVANCED AND SUSTAINABLE TURBOMACHINERY Modern trends – transonic and supersonic compressors – contra-rotating fans – hybrid-electric and distributed propulsion systems – ceramic and composite materials in turbomachinery – additive manufacturing in blades – performance improvement techniques – environmental and sustainability considerations.	**09 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:** **45**

Learning Resources

Textbooks:

1. Yahya, S.M., Turbines, Compressors and Fans, Tata McGraw-Hill, 2018.
2. Dixon, S.L. & Hall, C.A., Fluid Mechanics and Thermodynamics of Turbomachinery, Elsevier, 2019.
3. Balje, O.E., Turbomachines: A Guide to Design, Selection and Theory, Wiley, 2017.

References:

1. Cumpsty, N.A., Compressor Aerodynamics, Longman, 2019.
2. Hill, P.G. & Peterson, C.R., Mechanics and Thermodynamics of Propulsion, Pearson, 2019.
3. Mattingly, J.D., Elements of Propulsion: Gas Turbines and Rockets, AIAA, 2018.

Online Educational Resources:

1. https://nptel.ac.in/courses/101101058
2. https://ocw.mit.edu/courses/16-540-internal-flows-in-turbomachines-spring-2006/
3. https://innovationspace.ansys.com/courses/learning-track/turbomachinery-aerodynamics/

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. V. Ramkumar, Turbomachinery Division, Gas Turbine Research Establishment (GTRE), DRDO	Dr. K. Rajendran, IIT Madras		Dr. R. Arulprakash, AERO
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEC012	Computational Heat Transfer	L	T	P	J	C
		2	0	1	0	3
Professional Elective		SDG	4, 9 & 13			

Pre-requisite courses	24AEI201 & 24MAI241	Data Book / Code book (If any)	Nil

Course Objectives:	
The purpose of taking this course is to:	
1	Understand governing equations of heat transfer and their mathematical formulation.
2	Apply numerical methods (FDM/FVM) for solving heat transfer problems.
3	Analyze conduction, convection, and radiation using computational approaches.
4	Use CFD tools for thermal simulations in aerospace applications.
5	Evaluate and validate computational results for engineering systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
		Revised Bloom's Level
CO1	Formulate and discretize governing equations for heat transfer problems.	Ap
CO2	Develop numerical schemes for one- and two-dimensional conduction and validate them using analytical solutions.	Ap
CO3	Apply computational techniques for convection and radiation problems in engineering applications.	Ap
CO4	Implement numerical algorithms using programming or CFD tools to simulate heat transfer.	C
CO5	Analyze computational results, verify accuracy, and interpret physical significance.	An
CO6	Perform CFD-based laboratory simulations to evaluate practical heat transfer cases.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	2	1	1	1	–	–	–	1	1	1	2	1
2	3	3	2	2	2	–	–	–	1	1	1	2	2
3	3	3	2	3	3	–	–	–	1	1	2	2	3

4	3	3	2	3	2	–	–	–	1	1	2	3	2
5	3	3	3	3	3	–	1	–	1	1	2	3	3
6	3	3	3	3	3	2	1	3	2	2	3	3	3

Course Content

INTRODUCTION TO COMPUTATIONAL HEAT TRANSFER Governing equations of heat conduction, convection, and radiation – classification of PDEs – boundary and initial conditions – discretization methods: finite difference and finite volume – stability, consistency, and convergence. **Practical Component** • Derivation and coding of 1D steady heat conduction using FDM. Grid independence and error estimation.	**6 Hours** **3 Hours**
FINITE DIFFERENCE FORMULATIONS FOR HEAT CONDUCTION 1D and 2D steady-state conduction – discretization with Dirichlet, Neumann, and Robin boundaries – Gauss-Seidel and TDMA solvers – transient heat conduction using explicit and implicit schemes – stability analysis. **Practical Component** • MATLAB/Python implementation of 2D conduction. Simulation of unsteady conduction using ANSYS Fluent	**6 Hours** **3 Hours**
CONVECTION HEAT TRANSFER COMPUTATIONS Governing equations for convective flows – discretization of advection–diffusion equation – upwind, central, and hybrid schemes – numerical diffusion and false diffusion – SIMPLE algorithm for flow and heat transfer coupling. **Practical Component** • Laminar flow heat transfer simulation in a pipe using CFD. Temperature field analysis in forced convection with different mesh resolutions.	**6 Hours** **3 Hours**
RADIATION HEAT TRANSFER COMPUTATIONS Radiative heat transfer equations – surface radiation and view factors – radiation exchange between diffuse-gray surfaces – numerical implementation using FVM for radiation – coupling of radiation with conduction and convection. **Practical Component** • Gray-body radiation analysis using CFD tools. Verification of radiation heat exchange using MATLAB code.	**6 Hours** **3 Hours**
APPLICATIONS AND CASE STUDIES CFD modeling for aerospace and thermal systems – heat exchanger simulation, cooling of turbine blades, electronic component cooling, and solar thermal analysis – best practices in CFD modeling, validation, and reporting. **Practical Component** • CFD simulation of a 2D heat exchanger using ANSYS Fluent. Validation against analytical or experimental data	**6 Hours** **3 Hours**

Theory Hours:30	**Tutorial Hours:0**	**Practical Hours:15**	**Project Hours:0**	**Total Hours:45**

Learning Resources

Textbooks:

1. Patankar, S. V., Numerical Heat Transfer and Fluid Flow, Taylor & Francis, 2021.

2. Versteeg, H. K., & Malalasekera, W., An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Pearson, 2020.
3. Anderson, D. A., Computational Fluid Mechanics and Heat Transfer, CRC Press, 2017.

References:

1. Jaluria, Y., & Torrance, K. E., Computational Heat Transfer, Taylor & Francis, 2018.
2. Moukalled, F., Mangani, L., & Darwish, M., The Finite Volume Method in Computational Fluid Dynamics, Springer, 2021.
3. Blazek, J., Computational Fluid Dynamics: Principles and Applications, Elsevier, 2022.

Online Educational Resources:

1. https://nptel.ac.in/courses/112104302
2. https://play.kth.se/channel/MJ2515+Numerical+Heat+Transfer+in+Energy+Technology/602524
3. https://www.aere.iastate.edu/~sharma/courses/cfd2/

Assessment
SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. K. S. Subramanian, Senior CFD Analyst, ANSYS India	Dr. R. Rajesh, Professor, IIT Madras		Dr. R. Arulprakash, AERO
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE013	Fatigue and Fracture Mechanics	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9 & 12			

Pre-requisite courses	24AET203	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamentals of fatigue failure mechanisms in engineering materials and structures.
2	Analyze stress-life and strain-life approaches for predicting fatigue life under cyclic loading.
3	Examine the physical mechanisms of fatigue including crack initiation, propagation, and final fracture.
4	Apply fracture mechanics concepts such as LEFM and EPFM for assessing cracked components.
5	Design engineering components considering variable amplitude loading and fracture-safe design philosophies, with emphasis on aerospace structures.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply stress–life (S–N) concepts including endurance limit and mean stress correction models (Goodman, Gerber, Soderberg) to estimate fatigue life of engineering components.	Ap
CO 2	Analyze cyclic stress–strain behavior and strain–life relationships to interpret material response under low-cycle fatigue conditions.	An
CO 3	Analyze physical mechanisms of fatigue including crack initiation, crack propagation, and final fracture using microstructural and fracture surface characteristics.	An
CO 4	Apply fracture mechanics principles such as LEFM and EPFM to evaluate crack growth behavior and fracture criteria in cracked components.	Ap
CO 5	Analyze fatigue design methodologies incorporating variable amplitude loading, damage accumulation theories, and fracture mechanics concepts for aerospace structures.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	2	2	3	2	-	2	2	-	2	3	2
2	3	3	3	2	3	-	-	2	2	-	2	3	2
3	3	2	2	2	2	2	2	2	2	-	2	3	2
4	3	3	2	2	3	2	2	2	2	-	2	3	3

5	3	3	3	3	3	3	3	2	2	-	2	3	3

Course Content	
FATIGUE OF STRUCTURES – STRESS LIFE S.N. curves – Endurance limits – Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams –Modifying Factors of Fatigue life.	**7 Hours**
FATIGUE OF STRUCTURES – STRAIN LIFE Monotonic Stress-Strain Behavior – Cyclic Stress-strain Behavior – Transient Behavior – Strain-Life Curve – Mean stress effects.	**7 Hours**
PHYSICAL ASPECTS OF FATIGUE Phases in fatigue life – Crack initiation – Crack growth – Final Fracture – Dislocations – Fatigue fracture surfaces.	**6 Hours**
FRACTURE MECHANICS Introduction – LEFM (Linear Elastic Fracture Mechanics) & EPFM (Elastic Plastic Fracture Mechanics) – Potential energy and surface energy – Griffith's theory – Irwin-Orwin extension of Griffith's theory to ductile materials.	**10 Hours**
VARIABLE AMPLITUDE LOADING Linear and Nonlinear damage theories – Cycle counting Techniques-Level crossing Counting, Peak Counting, Rain flow Counting	**7 Hours**
FATIGUE DESIGN AND TESTING Fatigue Design philosophies –Importance of Fracture Mechanics in aerospace structures	**8 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Stephens, R. I., Fatemi, A., Stephens, R. R., & Fuchs, H. O., Metal Fatigue in Engineering, 2nd Edition, Wiley, 2000.
2. Anderson, T. L., Fracture Mechanics: Fundamentals and Applications, 4th Edition, CRC Press, 2017.
3. Suresh, S., Fatigue of Materials, 2nd Edition, Cambridge University Press, 2004.

References:

1. Julie A. Bannantine, "Fundamentals of Metal Fatigue Analysis" 1st Edition, Pearson Education (US), 1990.
2. C. R. Brooks and A. Choudhury, "Failure Analysis of Engineering Materials", McGraw-Hill, 2002.
3. Dowling, N. E., Mechanical Behavior of Materials, 4th Edition, Pearson, 2019.
4. Broek, D., Elementary Engineering Fracture Mechanics, Springer, 2012.

Online Educational Resources:

1. MIT OpenCourseWare – Fatigue and Fracture
   https://ocw.mit.edu/courses/materials-science-and-engineering/3-35-fracture-and-fatigue-fall-2003/
2. Cranfield University – Introduction to Fatigue and Fracture Analysis
   https://www.cranfield.ac.uk/courses/short/aerospace/introduction-to-fatigue-and-fracture-analysis
3. TU Delft – Fatigue of Structures and Materials
   https://online-learning.tudelft.nl/courses/fatigue-of-structures-and-materials/
4. NPTEL – Fatigue and Fracture Mechanics
   https://nptel.ac.in/courses/112106065/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-	-	Dr. Naveen Kumar K	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE014	Experimental Stress Analysis	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9 & 12			

Pre-requisite courses	24AEI302	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the relationship between theoretical mechanics and experimental stress analysis.
2	Analyze the response of structures under different loading conditions using experimental techniques.
3	Apply modern measurement techniques for stress and strain analysis.
4	Evaluate strain measurement systems and data interpretation methods.
5	Understand non-destructive testing techniques for structural integrity assessment.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Identify parameters influencing measurement system behaviour.	An
CO2	Apply extensometers for measuring deformation in materials.	Ap
CO3	Analyse strain gauge data using rosette methods under various loading conditions.	An
CO4	Apply experimental techniques such as photo elasticity and strain gauges for stress analysis.	Ap
CO5	Evaluate defects in materials using non-destructive testing methods.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
CO1	3	2	1	1	1	–	–	1	1	–	1	2	1
CO2	3	2	2	2	2	–	–	1	1	–	1	3	2
CO3	3	3	2	2	2	–	–	1	1	–	1	3	2
CO4	3	2	2	2	2	–	–	1	1	–	1	3	2
CO5	3	3	2	3	3	1	2	2	2	1	2	3	3

Course Content	
MEASUREMENTS Principles of measurement – Accuracy – Precision – Sensitivity – Range – Calibration – Errors in measurement – Signal conditioning – Data acquisition systems – Digital measurement techniques.	**5 Hours**
EXTENSOMETERS Mechanical extensometers – Optical extensometers – Electrical extensometers – Acoustical extensometers – Advantages and limitations – Modern displacement sensors.	**10 Hours**
STRAIN GAUGES Strain measurement fundamentals – Types of strain gauges – Electrical resistance strain gauge – Gauge factor – Temperature effects – Adhesives – Strain gauge circuits – Wheatstone bridge – Strain rosette analysis.	**12 Hours**
PHOTOELASTICITY Basic optics – Polarized light – Birefringence – Stress-optic law – Fringe patterns – Plane and circular polariscope – Digital photoelasticity – Fringe analysis	**10 Hours**
NON-DESTRUCTIVE TESTING Fundamentals of NDT – Radiography – Ultrasonic testing – Magnetic particle inspection – Dye penetrant testing – Eddy current testing – Acoustic emission technique- Holography – Thermography – Fibre optic sensors.	**8 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Dr. Sadhu Singh, 'Experimental Stress Analysis', Khanna Publications, 2009.
2. Dally, J.W., and Riley, W.F., 'Experimental Stress Analysis', College House Enterprises, New York, Fourth Edition, 2005.
3. Srinath, L.S., Raghava, M.R., Lingaiah,K., Garagesha,G. Pant B. and Ramachandra,K., 'Experimental Stress Analysis', Tata McGraw-Hill, New Delhi, 1984.

References:

1. J. Srinivas, 'Stress Analysis and Experimental Techniques: An Introduction', Alpha Science International Ltd, 2012.
2. Jindal, U. C., Experimental Stress Analysis, Pearson Education, 2012.
3. Freddi, A., Olmi, G., and Cristofolini, L., Experimental Stress Analysis for Materials and Structures, Springer, 2015.

Online Educational Resources:

1. https://onlinecourses.nptel.ac.in/noc21_me02/preview
2. https://nptel.ac.in/courses/113106070
3. https://home.iitm.ac.in/kramesh/Experimental%20Mechanics%20Laboratory%20Manual.pdf

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. R. Santhanam, Scientist "F' DRDO	Dr. S Venkatachalam Karunya Institute of Technology and Sciences		Mr.Raj Kumar G /AERO Dr K. Naveen Kumar/ AERO
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE015	Vibrations & Aeroelasticity	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9 & 12			

Pre-requisite courses	24AET209	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental concepts of vibration and dynamic systems.
2	Analyze free and forced vibration behavior of single degree-of-freedom systems.
3	Apply mathematical techniques to solve multi-degree-of-freedom systems.
4	Evaluate vibration characteristics of continuous systems and approximate methods.
5	Understand aeroelastic phenomena and their effects on aircraft structures.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain fundamental concepts of vibration and dynamic systems	An
CO2	Analyze SDOF systems for free and forced vibrations	An
CO3	Apply methods to determine natural frequencies and mode shapes of MDOF systems	Ap
CO4	Analyze vibration characteristics of continuous systems	An
CO5	Evaluate aeroelastic effects such as divergence, flutter, and control reversal	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	1	1	–	–	1	1	–	1	3	1
2	3	3	2	2	2	–	–	1	1	–	1	3	2
3	3	3	2	2	2	–	–	1	1	–	1	3	2
4	3	2	1	2	1	–	–	1	1	–	1	3	1
5	3	3	2	2	2	1	2	2	1	1	1	3	2

Course Content

SINGLE DEGREE OF FREEDOM SYSTEMS – FREE VIBRATION Basic concepts – Terminology – Simple harmonic motion – Newton's law – D'Alembert's principle – Energy methods – Undamped free vibration – Damped vibration – Logarithmic decrement.	**9 Hours**

SINGLE DEGREE OF FREEDOM SYSTEMS – FORCED VIBRATION Forced vibration – Harmonic excitation – Resonance – Damped and undamped systems – Support/base excitation – Transmissibility – Vibration measuring instruments.	**10 Hours**
MULTI DEGREES OF FREEDOM SYSTEM Two degree-of-freedom systems – Static and dynamic coupling – Principal coordinates – Mode shapes – Orthogonality – Eigenvalue problems – Lagrange's equations – Vibration absorber.	**10 Hours**
CONTINUOUS SYSTEMS Vibration of strings – Longitudinal and transverse vibration – Torsional vibration – Beam vibration – Approximate methods – Rayleigh method – Holzer method.	**8 Hours**
ELEMENTS OF AEROELASTICITY Introduction – Collar's triangle – Static aeroelasticity – Divergence – Control reversal – Dynamic aeroelasticity – Flutter – Aeroelastic instabilities and prevention techniques.	**8 Hours**

Theory Hours: 45	**Tutorial Hours: 0**	**Practical Hours: 0**	**Project Hours: 0**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Singiresu S. Rao, 'Mechanical Vibrations', 5th Edition, Prentice Hall, 2011.
2. Leonard Meirovitch, 'Fundamentals of Vibrations', Tata McGraw Hill, 2001.
3. Dukkipati, R. V. and Srinivas, J., 'Textbook of Mechanical Vibrations', Second Edition PHI,2012.

References:

1. V. P. Singh, 'Mechanical Vibrations', Fourth Edition, Dhanpat Rai and Co., 2014.
2. Bisplinghoff R.L., Ashley H and Hogman R.L., 'Aero elasticity', Addition Wesley Publication, New York, 1983.
3. Fung Y.C., 'An Introduction to the Theory of Aero elasticity', John Wiley and Sons, New York, 1995.

Online Educational Resources:

1. https://nptel.ac.in/courses/112107212
2. https://nptel.ac.in/courses/101104005
3. https://www.youtube.com/watch?v=j-zczJXSxnw

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentations & Demonstrations (Using working models & Software tools) & Lab Visits, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Dr. R. Santhanam, Scientist "F" DRDO	Dr. S Venkatachalam Karunya Institute of Technology and Sciences		Mr.Raj Kumar G /AERO Dr K. Naveen Kumar/ AERO
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE016	Smart Materials for Aerospace	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9, 11 & 12			

Pre-requisite courses	24AET203	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamentals of smart materials, smart structures, and intelligent systems.
2	Explain the working principles and characteristics of major classes of smart materials.
3	Analyze sensing, actuation, control, and data acquisition aspects of smart systems.
4	Apply modeling and design concepts for smart materials and structures.
5	Explore emerging smart material technologies and their applications in aerospace and allied engineering fields.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the concepts, components, and functioning of smart materials, smart structures, and smart systems including open-loop and closed-loop configurations.	U
CO 2	Analyze the working principles and material behavior of major smart materials such as PZTs, SMAs, MSMs, ERFs, MRFs, and Fiber Optics.	An
CO 3	Apply modeling, design, and analysis concepts to selected smart materials and smart structural systems.	Ap
CO 4	Analyze sensing, actuation, control, and data acquisition systems used in smart structures.	An
CO 5	Analyze emerging smart materials, SHM, MEMS/NEMS, biomimetics, and AI-based smart systems for advanced engineering applications.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	1	-	2	2	-	2	2	-	2	2	1
2	3	3	2	2	3	-	-	2	2	-	2	3	2
3	3	3	3	2	3	-	-	2	2	-	2	3	3
4	3	3	2	2	3	-	-	2	2	-	2	3	2
5	3	3	2	3	3	3	2	2	2	-	3	3	3

Course Content

INTRODUCTION TO SMART MATERIALS, STRUCTURES AND SYSTEMS Definition of smart materials, smart structures and smart systems, need for smart structures, components of smart systems, types and applications of smart structures, basics of sensors, actuators, processors, controllers and data acquisition systems, open-loop and closed-loop smart systems, advantages and disadvantages of smart structures and systems, design aspects and challenges in smart structures and systems.	**8 Hours**
SMART MATERIALS: PRINCIPLES AND CLASSIFICATION Working principles and classification of smart materials, behavior, characteristics and properties of piezoelectric materials (PZTs), shape memory alloys (SMAs), magnetostrictive materials (MSMs), electro-rheological fluids (ERFs), magneto-rheological fluids (MRFs) and fiber optic materials (FOs), comparison of smart materials based on performance characteristics.	**10 Hours**
MODELLING, DESIGN AND APPLICATIONS OF SMART MATERIALS Modelling concepts of smart materials, design and analysis of smart material-based systems, experimental aspects and characterization techniques, integration of smart materials in structures, applications of smart materials in aerospace, mechanical and civil engineering systems, limitations and practical considerations.	**9 Hours**
OTHER SMART MATERIALS AND SMART STRUCTURES Other smart materials including chromic materials, smart ceramics, smart fluids, gels, polymers and smart composites, multifunctional smart structures, adaptive and morphing structures, challenges in large-scale implementation of smart materials.	**9 Hours**
EMERGING TRENDS AND INTELLIGENT SYSTEMS Structural Health Monitoring (SHM) concepts and techniques, Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS), biomimetics in smart structures, artificial intelligence and neural networks in smart systems, future research opportunities and emerging applications.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Gandhi, M. V., & Thompson, B. S., Smart Materials and Structures, Springer, 1992.
2. Culshaw, B., & Dakin, J., Smart Structures and Materials, Artech House, 1999.
3. Srinivasan, A. V., & McFarland, D. M., Smart Structures: Analysis and Design, Cambridge University Press, 2001.

References:

1. Leo, D. J., Engineering Analysis of Smart Material Systems, Wiley, 2007.
2. Ikeda, T., Fundamentals of Piezoelectricity, Oxford University Press, 1996.
3. Rao, S. S., Engineering Optimization and Smart Structures, Wiley, 2019.

Online Educational Resources:

1. NPTEL – Smart Materials and Intelligent Systems
2. MIT OpenCourseWare – Smart Structures
3. Cranfield University – Smart Structures and Systems
4. TU Delft – Intelligent Structures and Materials

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. Naveen Kumar K
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE017	Theory of Elasticity	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9, 11 & 12			

Pre-requisite courses	24AET203	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the fundamental assumptions, definitions, and constitutive relations governing elastic solids.
2	Derive and apply basic equations of elasticity including equilibrium, compatibility, and stress–strain relations.
3	Analyze two-dimensional elasticity problems under plane stress and plane strain conditions.
4	Solve elasticity problems using stress functions in Cartesian and polar coordinates.
5	Apply elasticity theory to torsion problems of prismatic bars with different cross-sections.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze stress–strain relations, elastic constants, and equilibrium equations based on assumptions of elasticity	An
CO 2	Analyze compatibility conditions, principal stresses and strains, and stress transformation using Mohr's circle.	An
CO 3	Apply Airy's stress function to solve plane stress and plane strain problems in Cartesian coordinates.	Ap
CO 4	Apply elasticity formulations in polar coordinates to solve axisymmetric and classical elasticity problems.	Ap
CO 5	Analyze torsion of prismatic bars using Navier's, Saint Venant's, and Prandtl's theories for various cross-sections.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	2	2	2	-	-	2	2	-	2	3	2
2	3	3	2	2	2	-	-	2	2	-	2	3	2
3	3	3	3	2	3	-	-	2	2	-	2	3	3
4	3	3	3	2	3	-	-	2	2	-	2	3	2
5	3	3	2	2	3	-	-	2	2	-	2	3	3

Course Content	
ASSUMPTIONS IN ELASTICITY Definitions – Notations and sign conventions for stress and strain Strain-displacement relations – Stress-strain relations – Lame's constant – cubical dilation – Compressibility of material – Bulk modulus – Shear modulus- Equations of equilibrium.	**7 Hours**
BASIC EQUATIONS OF ELASTICITY Compatibility equations for stresses and strains - Principal stresses and principal strains – Mohr's circle – Saint Venant's principle.	**10 Hours**
PLANE STRESS AND PLANE STRAIN PROBLEMS Airy's stress function – Bi-harmonic equations – Polynomial solutions – Simple two-dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams.	**10 Hours**
POLAR COORDINATES Equations of equilibrium – Strain displacement relations – Stress-strain relations – Airy's stress function – Axisymmetric problems – Kirsch-Michell's and Boussinasque problems.	**10 Hours**
TORSION Navier's theory – St. Venant's theory – Prandtl's theory on torsion – Semi-inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections.	**8 Hours**

Theory Hours:	**45**	**Tutorial Hours:**		**Practical Hours:**		**Project Hours:**		**Total Hours:**	**45**

Learning Resources

Textbooks:

1. Timoshenko, S. P., and Goodier, J. N., 'Theory of Elasticity', Third Edition, McGraw-Hill Ltd., Tokyo, 1970.
2. Sadd, M. H., Elasticity: Theory, Applications, and Numerics, 3rd Edition, Academic Press, 2014.
3. Ugural, A. C., & Fenster, S. K., Advanced Strength and Applied Elasticity, 5th Edition, Pearson, 2012.

References:

1. Enrico Volterra and J.H. Caines, 'Advanced Strength of Materials', Prentice Hall New Jersey, 1991.
2. Wang, C.T., 'Applied Elasticity', McGraw-Hill Co., New York, 1993.
3. Sokolnikoff, I.S., 'Mathematical Theory of Elasticity', McGraw-Hill, New York, 1978.
4. P.N Chandramouli., 'Theory of Elasticity', Yes Dee Publishing, 2017.

Online Educational Resources:

1. NPTEL – Theory of Elasticity
   https://onlinecourses.nptel.ac.in/noc21_ce45
2. https://www.youtube.com/watch?v=eICv1p8WjgI&list=PLbRMhDVUMngcbhsZgRWuYCi2kKQwQ0Av1
3. IIT Bombay – Advanced Mechanics of Solids (Elasticity modules)
4. TU Delft – Continuum Mechanics & Elasticity
   https://online-learning.tudelft.nl

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. Naveen Kumar K
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEC018	Aero-Structural Optimization	L	T	P	J	C
		2	0	1	0	3
Professional Elective		SDG	9 & 13			

Pre-requisite courses	24AEI302	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the formulation of structural optimization problems, design variables, objective functions and constraints in aerospace.
2	Apply classical optimization algorithms including linear programming, nonlinear programming and KKT conditions to structural problems.
3	Solve sizing, shape and topology optimization problems using gradient-based methods, sensitivity analysis and finite-element coupling.
4	Apply metaheuristic and evolutionary algorithms including genetic algorithm and particle swarm optimization for aerospace design problems.
5	Analyse multi-disciplinary design optimization frameworks integrating aerodynamics, structures and propulsion for aircraft and UAV design.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify and formulate aerospace structural optimization problems with appropriate design variables and constraints.	Ap
CO 2	Apply classical optimization algorithms including linear and nonlinear programming to structural design problems.	Ap
CO 3	Solve sizing, shape and topology optimization problems using gradient-based methods coupled with finite-element analysis.	Ap
CO 4	Apply metaheuristic and evolutionary algorithms including genetic algorithm and particle swarm to aerospace structural design.	Ap
CO 5	Analyse multi-disciplinary design optimization frameworks for integrated aircraft and UAV structural design.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO1	PSO2
1	3	3	2	2	2	-	-	-	-	-	2	3	3
2	3	3	2	2	3	-	-	-	-	-	2	3	3

3	3	3	3	3	3	-	-	-	-	-	2	3	3
4	3	3	3	2	3	-	-	-	-	-	2	3	3
5	3	3	3	3	3	2	-	-	-	2	3	3	3

Course Content

INTRODUCTION TO OPTIMIZATION Definition and scope of engineering optimization - Aerospace structural optimization problems - Design variables, objective functions and constraints - Classification of optimization problems - Convex and non-convex problems - Existence and uniqueness of solutions - Graphical method for two-variable problems - Aerospace case studies of structural optimization.	**6 Hours**
Practical Component: • Formulation and Graphical Visualisation of Two-Variable Structural Optimization Problems using MATLAB • Convex vs Non-Convex Function Visualisation and Local-Global Minima Identification using Python (Matplotlib / SciPy)	**3 Hours**
CLASSICAL OPTIMIZATION METHODS Single-variable optimization - Multivariable optimization without constraints - Steepest descent and conjugate gradient methods - Newton and quasi-Newton methods - Constrained optimization - Lagrange multipliers - Karush-Kuhn-Tucker (KKT) conditions - Linear programming and simplex method - Sequential linear programming - Sequential quadratic programming for structural problems.	**6 Hours**
Practical Component: • Unconstrained Minimisation of a Structural Compliance Function using MATLAB fminunc • Constrained Optimization of a Truss Mass Subject to Stress Constraints using MATLAB fmincon	**3 Hours**
SENSITIVITY ANALYSIS AND STRUCTURAL OPTIMIZATION Sensitivity analysis for FE-based design - Direct and adjoint methods for sensitivity - Sizing optimization of bar and beam elements - Shape optimization basics - Topology optimization using SIMP method - Optimality criteria methods - Aerospace applications including wing spar caps, fuselage stringers and brackets.	**6 Hours**
Practical Component: • Sizing Optimization of a Cantilever Beam (Cross-Sectional Area Minimisation) using ANSYS Workbench Design Optimization • Topology Optimization of an Aerospace Bracket using ANSYS Workbench Topology Optimization Module	**3 Hours**
METAHEURISTIC AND EVOLUTIONARY ALGORITHMS Limitations of gradient-based methods for non-convex problems - Introduction to metaheuristics - Genetic Algorithm (GA) including selection, crossover and mutation - Particle Swarm Optimization (PSO) - Simulated annealing - Differential evolution - Comparison of metaheuristic methods - Applications to airfoil shape optimization and laminate stacking sequence.	**6 Hours**
Practical Component: • Genetic Algorithm Implementation for Composite Laminate Stacking-Sequence Optimization using Python (DEAP)	**3 Hours**

• Particle Swarm Optimization of a NACA Airfoil Shape using Python (pyOpt / pyswarms) coupled with XFOIL	
MULTI-DISCIPLINARY DESIGN OPTIMIZATION (MDO) Concept of multi-disciplinary design optimization - Coupled disciplines in aircraft design (aerodynamics, structures, propulsion, controls) - MDO architectures including monolithic and distributed approaches - Multi-objective optimization and Pareto fronts - Surrogate modelling and response-surface methods - MDO case studies for wing design, UAV design and conceptual aircraft design. **Practical Component:** • Multi-Objective Pareto-Front Generation for Wing Sizing using NSGA-II in Python • Wing Aero-Structural MDO using OpenMDAO Framework with FEA and Lifting-Line Coupling	**6 Hours** **3 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:15	Project Hours:0	Total Hours:45

Learning Resources

Textbooks:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice, 5th Ed., John Wiley and Sons, 2019.
2. Joaquim R. R. A. Martins and Andrew Ning, Engineering Design Optimization, Cambridge University Press, 2021.
3. Jasbir S. Arora, Introduction to Optimum Design, 4th Ed., Academic Press, 2017.

References:

1. Raphael T. Haftka and Zafer Gurdal, Elements of Structural Optimization, 3rd Ed., Springer, 1992.
2. Ashok D. Belegundu and Tirupathi R. Chandrupatla, Optimization Concepts and Applications in Engineering, 2nd Ed., Cambridge University Press, 2011.
3. Peter W. Christensen and Anders Klarbring, An Introduction to Structural Optimization, Springer, 2009.
4. Garret N. Vanderplaats, Numerical Optimization Techniques for Engineering Design, 4th Ed., Vanderplaats Research and Development, 2007.

Online Educational Resources:

1. https://nptel.ac.in/courses/112106131
2. https://nptel.ac.in/courses/112105235
3. https://ocw.mit.edu/courses/16-888-multidisciplinary-system-design-optimization-spring-2010/
4. https://openmdao.org/ (OpenMDAO documentation and tutorials for MDO)
5. https://www.altair.com/optistruct

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. Naveen Kumar K
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE019	Avionics & Aerospace Electronics	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamental concepts, architecture, and evolution of avionics systems used in aerospace applications.
2	To provide knowledge on aerospace sensors, instrumentation systems, and air data measurement techniques used in aircraft systems.
3	To familiarize students with aircraft communication, navigation, surveillance, and radar systems used in modern aviation.
4	To develop understanding of flight control, autopilot, guidance, and stability augmentation systems in aircraft.
5	To expose students to modern avionics architectures, avionics data buses, fault-tolerant systems, and UAV avionics integration concepts.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the evolution, architecture, and fundamental concepts of avionics systems used in civil and military aircraft.	U
CO 2	Analyze the working principles and applications of aerospace sensors, instrumentation, and air data systems.	An
CO 3	Describe aircraft communication, navigation, surveillance, and radar systems used in modern aerospace operations.	U
CO 4	Explain the principles and operation of flight control, guidance, autopilot, and stability augmentation systems.	U
CO 5	Explain the modern avionics architectures, avionics data buses, fault-tolerant systems, and UAV avionics integration techniques.	U

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	-	-	-	-	-	2	3	-
2	3	3	1	2	2	-	-	-	-	-	2	3	-

3	3	2	1	1	2	-	-	-	-	-	2	3	-
4	3	3	2	2	2	-	-	-	-	-	2	3	2
5	3	3	2	2	2	-	-	-	-	-	2	3	-

Course Content

INTRODUCTION TO AVIONICS Definition and evolution of avionics, civil and military avionics systems, avionics system architecture, analog and digital avionics systems, basic concepts of fly-by-wire systems, overview of Integrated Modular Avionics (IMA).	**9 Hours**
AEROSPACE SENSORS AND INSTRUMENTATION Sensors for aerospace applications including pressure, temperature, acceleration and gyroscopic sensors, air data systems and flight instruments such as altimeter and airspeed indicator, inertial sensors and Inertial Measurement Unit (IMU), signal conditioning and data acquisition systems, error sources and calibration techniques.	**9 Hours**
COMMUNICATION, NAVIGATION AND SURVEILLANCE SYSTEMS Aircraft communication systems including VHF, HF and SATCOM basics, navigation systems such as VOR, DME, ILS and GNSS (GPS basics), Inertial Navigation System (INS), strapdown INS, surveillance systems including primary radar and Secondary Surveillance Radar (SSR), aircraft transponders (Mode A, C and S), altitude reporting using Gillham Code, TCAS and ADS-B basics, radar systems and aerospace data link systems.	**9 Hours**
FLIGHT CONTROL AND GUIDANCE SYSTEMS Manual and automatic flight control systems, fly-by-wire and fly-by-light systems, autopilot systems, Stability Augmentation Systems (SAS), basics of aerospace guidance and control systems.	**9 Hours**
MODERN AVIONICS AND SYSTEM INTEGRATION Integrated Modular Avionics (IMA), avionics data buses including ARINC 429 and MIL-STD-1553, fault tolerance and redundancy techniques, aircraft health monitoring systems, introduction to UAV avionics and system integration.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. R. P. G. Collinson, Introduction to Avionics Systems, 4th Edition, Springer, 2023.
2. Albert Helfrick, Principles of Avionics, 9th Edition, Avionics Communications Inc., 2015.
3. Cary R. Spitzer (Ed.), Uma Ferrell (Ed.) and Thomas Ferrell (Ed.), Digital Avionics Handbook, Third Edition, CRC Press, 2014.
4. Ian Moir, Allan Seabridge and Malcolm Jukes, Civil Avionics Systems, Second Edition, Wiley, 2013.
5. E. H. J. Pallett, Aircraft Instruments & Integrated Systems, Longman House, 1992.

References
1. Myron Kayton and Walter R. Fried, Avionics Navigation Systems, Second Edition, John Wiley and Sons, 1997. 2. Cary R. Spitzer (Ed.), The Avionics Handbook, CRC Press, 2001. 3. Ian Moir, Allan Seabridge, and Roy Langton, Aircraft Systems: Mechanical, Electrical, and Avionics Subsystems Integration, 3rd Edition, Wiley, 2011. 4. Alexander V. Nebylov (Ed.), Aerospace Sensors, Momentum Press, 2013.
Online Educational Resources:
1. Advanced Avionics Handbook: https://www.govinfo.gov/content/pkg/GOVPUB-TD4-PURL-gpo46261/pdf/GOVPUB-TD4-PURL-gpo46261.pdf

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, Circuit Design, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEC020	Drone Fabrication and Testing	L	T	P	J	C
		2	0	1	0	3
Professional Elective		SDG	9 & 11			

Pre-requisite courses	-	Data Book / Code book (If any)	-

Course Objectives:	
The purpose of taking this course is to:	
1	Understand drone classifications, configurations and the DGCA regulatory framework for civil drone operations.
2	Apply material selection and fabrication techniques for drone airframes including composite, polymer and metal components.
3	Integrate propulsion systems, electronic speed controllers, batteries, sensors and avionics on a drone platform.
4	Configure open-source autopilot systems including PX4 and ArduPilot with ground control stations and telemetry for autonomous flight.
5	Analyse drone performance through ground testing and flight testing and assess airworthiness for certification.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify drone classifications, configurations and DGCA/CAR regulatory requirements for civil drone operations.	Ap
CO 2	Apply material selection and fabrication techniques for drone airframe components and assemblies.	Ap
CO 3	Integrate propulsion, ESCs, batteries, sensors and avionics on a multirotor or fixed-wing drone platform.	Ap
CO 4	Configure open-source autopilot, ground control station and telemetry systems for autonomous drone operations.	Ap
CO 5	Analyse drone performance through ground and flight testing and interpret post-flight log data.	An

Course Outcomes (COs)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1 Engineering Knowledge	2 Problem Analysis	3 Design/Development of Solutions	4 Conduct Investigations of Complex Problems	5 Engineering Tool Usage	6 The Engineer and The World	7 Ethics	8 Individual and Collaborative Team work	9 Communication	10 Project Management and Finance	11 Life-Long Learning	PSO1	PSO2
1	3	2	2	1	2	2	2	-	-	-	2	3	2
2	3	3	3	2	3	2	-	-	-	2	2	3	3

3	3	3	3	2	3	2	-	-	-	2	2	3	3
4	3	3	3	3	3	-	-	-	-	2	3	3	3
5	3	3	2	3	3	3	2	-	-	2	3	3	3

Course Content

INTRODUCTION TO DRONES AND REGULATIONS History and evolution of unmanned aircraft systems - Drone classifications by size, weight and configuration - Multirotor, fixed-wing and hybrid VTOL configurations - Civil and military applications - DGCA Drone Rules 2021 and Civil Aviation Requirements (CAR) - Airspace categorisation including red, yellow and green zones - Digital Sky platform and remote pilot certification requirements. **Practical Component:** • Drone Classification and Configuration Selection Exercise based on Mission Requirements • Digital Sky Portal Walk-through and No-Permission-No-Take-off (NPNT) Compliance Familiarisation	**6 Hours** **3 Hours**
DRONE AIRFRAME DESIGN AND FABRICATION Airframe materials including carbon-fibre composites, glass-fibre composites, ABS and PLA polymers, aluminium and balsa wood - Design considerations for thrust-to-weight ratio and centre of gravity - 3D printing for drone components - Carbon-fibre tube cutting and bonding - Frame assembly techniques - Vibration isolation - Landing gear design and integration of payload bays. **Practical Component:** • Fabrication of a Carbon-Fibre Tube Multirotor Arm and Frame Assembly • 3D Printing of a Drone Body and Motor Mount using PLA / PETG with Subsequent Frame Assembly	**6 Hours** **3 Hours**
PROPULSION AND ELECTRONICS INTEGRATION Brushless DC motors and KV rating - Propeller selection and pitch effects - Electronic speed controllers (ESC) and BLHeli firmware - Lithium polymer batteries and C-rating - Power distribution boards - Sensor suite including IMU, barometer, magnetometer and GPS - Wiring harness preparation - Soldering best practices and electromagnetic interference considerations. **Practical Component:** • ESC Calibration, Motor Direction Setting and Thrust Measurement on a Bench Thrust Stand • Power System Integration including PDB, ESCs, Motors, Battery and Sensor Wiring on a Quadcopter Frame	**6 Hours** **3 Hours**
AUTOPILOT, GROUND CONTROL AND COMMUNICATION SYSTEMS Open-source autopilot platforms including Pixhawk, PX4 and ArduPilot - Flight modes including manual, stabilised, altitude-hold, position-hold and auto - Ground Control Station software including Mission Planner and QGroundControl - Telemetry radios and frequency selection - Failsafe configurations - PID tuning of attitude controllers - First-person-view systems and camera integration. **Practical Component:** • Pixhawk / PX4 Autopilot Configuration using QGroundControl including Sensor Calibration and Mode Setup	**6 Hours** **3 Hours**

• Mission Planning, Waypoint Upload and Telemetry Link Testing using Mission Planner with ArduPilot	
GROUND TESTING, FLIGHT TESTING AND CERTIFICATION Pre-flight checks and safety procedures - Static thrust testing - Vibration analysis and motor balancing - Tethered hover testing - Open-loop and closed-loop flight tests - Autonomous mission flight tests - Flight log analysis using log review tools - DGCA Type Certificate and operator licensing requirements - Documentation for airworthiness compliance. **Practical Component:** • Tethered Hover Test, Manual Hover and Stabilised-Mode Flight Testing with PID Tuning • Autonomous Waypoint Mission Flight Test, Telemetry Recording and Post-Flight Log Analysis	**6 Hours** **3 Hours**

Theory Hours:30	Tutorial Hours:0	Practical Hours:15	Project Hours:0	Total Hours:45

Learning Resources

Textbooks:

1. Reg Austin, Unmanned Aircraft Systems: UAVS Design, Development and Deployment, John Wiley and Sons, 2010.
2. Paul Gerin Fahlstrom and Thomas James Gleason, Introduction to UAV Systems, 4th Ed., John Wiley and Sons, 2012.
3. Kenzo Nonami, Farid Kendoul, Satoshi Suzuki, Wei Wang and Daisuke Nakazawa, Autonomous Flying Robots, Springer, 2010.

References:

1. Randal W. Beard and Timothy W. McLain, Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012.
2. Kimon P. Valavanis and George J. Vachtsevanos (Eds.), Handbook of Unmanned Aerial Vehicles, Springer, 2015.
3. Directorate General of Civil Aviation, Drone Rules 2021 and Civil Aviation Requirements (CAR) Section 3, Government of India, 2021.
4. Quan Quan, Introduction to Multicopter Design and Control, Springer, 2017.

Online Educational Resources:

1. https://nptel.ac.in/courses/101104073
2. https://docs.px4.io/main/en/
3. https://ardupilot.org/copter/
4. https://digitalsky.dgca.gov.in/ (DGCA Digital Sky Platform for drone registration)
5. https://dronecode.org/

Assessment

SA I and SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Mr. R. Vijayanandh
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEC021	UAV Design & Simulation	L	T	P	J	C
		2	0	1	0	3
Professional Elective		SDG	9, 12 & 13			

Pre-requisite courses	24AEI206	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Introduce the fundamentals of multirotor UAV systems and their applications.
2	Develop the ability to perform mission-based UAV sizing and component selection.
3	Provide knowledge of multirotor aerodynamics, propulsion systems and performance estimation.
4	Introduce UAV flight dynamics, stability concepts and PID-based control.
5	Enable students to simulate, assemble, configure and test a multirotor UAV using industry-standard tools.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the architecture and operating principles of multirotor UAV systems.	U
CO 2	Apply mission requirements to select and size UAV components.	Ap
CO 3	Analyze multirotor aerodynamic and propulsion performance.	An
CO 4	Evaluate UAV stability and control characteristics through simulation and tuning.	E
CO 5	Develop and validate a complete multirotor UAV design through simulation and hardware integration.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	2	-	-	-	1	-	1	3	1
2	3	3	3	2	2	-	-	-	1	-	1	3	2
3	3	3	2	2	2	-	-	-	1	-	1	3	2
4	3	3	2	2	3	-	-	-	1	-	1	3	3
5	3	3	3	2	3	-	-	2	2	1	2	3	3

Course Content	
Introduction to Multirotor UAV Systems Evolution of UAVs – classification of UAVs – multirotor configurations (tricopter, quadcopter, hexacopter, octocopter) – UAV subsystems – airframe, flight controller, ESC, BLDC motor, propeller, battery, radio transmitter and receiver – payloads and applications – mission requirements – UAV design workflow – introduction to Mission Planner and MATLAB-based UAV simulation. **Practical Component:** • Familiarization with UAV hardware components • Assembly of a basic quadcopter frame • Introduction to Mission Planner / MATLAB UAV environment	**6 Hours** **3 Hours**
UAV Design and Component Selection Mission analysis – payload determination – endurance and flight time estimation – thrust-to-weight ratio – motor selection – propeller selection – ESC sizing – battery capacity estimation – frame selection – weight build-up – preliminary UAV sizing. **Practical Component:** • Mission requirement analysis for surveillance or mapping application • UAV design spreadsheet preparation • Component matching and battery sizing	**6 Hours** **3 Hours**
Multirotor Aerodynamics and Propulsion Rotor aerodynamics – thrust generation mechanism – momentum theory concepts – effect of propeller diameter and pitch – power consumption – hovering performance – climb and descent performance – propulsion efficiency – multirotor performance estimation. **Practical Component:** • Static thrust measurement • Propeller performance comparison • Performance analysis	**6 Hours** **3 Hours**
Flight Dynamics, Stability and Control Multirotor degrees of freedom – forces and moments acting on a quadcopter – roll, pitch and yaw motion – stability concepts – flight controller architecture – IMU sensors (accelerometer and gyroscope) – PID control fundamentals – tuning parameters – autonomous flight concepts. **Practical Component:** • Sensor calibration and flight controller configuration • PID tuning in simulation • Roll, pitch and yaw response analysis	**6 Hours** **3 Hours**

UAV Integration, Simulation and Validation Simulation-based UAV development – Software-in-the-loop (SITL) concepts – mission planning – waypoint navigation – failsafe features – system integration – troubleshooting – UAV testing procedures.	**6 Hours**
Practical Component: • Mission planning and waypoint simulation • Flight controller setup and system integration • Final UAV design demonstration	**3 Hours**

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 15	Project Hours: 0	Total Hours: 45

Learning Resources

Textbooks

1. Paul G. Fahlstrom and Thomas J. Gleason, Introduction to UAV Systems, 5th Edition, Wiley, 2022.
2. Randal W. Beard and Timothy W. McLain, Small Unmanned Aircraft: Theory and Practice, 1st Edition, Princeton University Press, 2012.
3. Andy Piper, Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1, 1st Edition, Apress, 2017.
4. Raff D'Andrea and Randal W. Beard, Quadrotorcraft Control: Vision-Based Hovering and Navigation, 1st Edition, Springer, 2017.
5. Reg Austin, Unmanned Aircraft Systems: UAVs Design, Development and Deployment, 1st Edition, Wiley, 2010.

References

1. Wayne Johnson, Rotorcraft Aeromechanics, 1st Edition, Cambridge University Press, 2013.
2. Brian L. Stevens, Frank L. Lewis and Eric N. Johnson, Aircraft Control and Simulation, 3rd Edition, Wiley, 2015.
3. Robert C. Nelson, Flight Stability and Automatic Control, 2nd Edition, McGraw-Hill Education, 1998 (Reprint).
4. Bernard Etkin and Lloyd Duff Reid, Dynamics of Flight: Stability and Control, 3rd Edition, Wiley, 1996 (Reprint).
5. Bandu N. Pamadi, Performance, Stability, Dynamics and Control of Airplanes, 3rd Edition, AIAA Education Series, 2015.

Online Educational Resources:

1. ArduPilot Documentation: https://ardupilot.org/
2. Mission Planner Documentation: https://ardupilot.org/planner
3. PX4 User Guide: https://docs.px4.io/
4. MATLAB UAV Toolbox Documentation: https://www.mathworks.com/products/uav.html

Assessment
SA I and SA II, Activity and Learning Task(s), MCQ, Report submission, viva-voce examination, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Mr. S. Muthukumar, Dept. of Aero, KCT
Recommended by BoS on	11.06.2026		
Academic Council Approval	No. 31	**Date**	19.06.2026

24AEE022	Autonomous Navigation & SLAM	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamental concepts and architectures of autonomous systems used in robotics, UAVs, and autonomous vehicles.
2	To provide knowledge on localization techniques and probabilistic methods used in autonomous navigation.
3	To develop understanding of mapping and Simultaneous Localization and Mapping (SLAM) techniques for autonomous systems.
4	To familiarize students with perception systems, computer vision, LiDAR sensing, and sensor fusion techniques.
5	To expose students to path planning, motion planning, obstacle avoidance, and real-world applications of autonomous navigation systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamentals of autonomous systems, navigation problems, coordinate transformations, and sensing technologies used in autonomous platforms.	U
CO 2	Analyze localization techniques including dead reckoning, Bayesian filtering, Kalman Filters, and Particle Filters used in autonomous navigation.	An
CO 3	Describe mapping techniques and SLAM methodologies including EKF-SLAM, graph-based SLAM, and loop closure concepts.	U
CO 4	Explain perception techniques, computer vision methods, LiDAR sensing, and sensor fusion approaches used in autonomous systems.	U
CO 5	Evaluate path planning, motion planning, and obstacle avoidance techniques for autonomous vehicles, drones, and robotic applications.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	2	-	-	-	-	-	2	3	2

2	3	3	1	2	3	-	-	-	-	-	2	3	3
3	3	3	2	2	3	-	-	-	-	-	2	3	3
4	3	2	2	2	3	-	-	-	-	-	2	3	3
5	3	3	3	2	3	-	-	-	-	-	2	3	3

Course Content

INTRODUCTION TO AUTONOMOUS SYSTEMS Overview of autonomous systems including Unmanned Ground Vehicles (UGV) and Unmanned Aerial Vehicles (UAV), levels of autonomy, navigation problems involving localization, mapping and planning, coordinate frames and coordinate transformations, overview of sensors used in autonomous systems including LiDAR, cameras, IMU and GPS.	**9 Hours**
LOCALIZATION TECHNIQUES Dead reckoning methods, probabilistic localization techniques, Bayesian filtering concepts, basics of Kalman Filter (KF), Particle Filter concepts and their applications in autonomous navigation systems.	**9 Hours**
MAPPING AND SLAM Mapping techniques including occupancy grid mapping and feature-based mapping, formulation of the Simultaneous Localization and Mapping (SLAM) problem, concepts of EKF-SLAM, introduction to graph-based SLAM, loop closure techniques in SLAM systems.	**9 Hours**
PERCEPTION AND SENSOR INTEGRATION Basics of computer vision including feature detection and feature matching, LiDAR-based perception techniques, sensor fusion methods in SLAM, fundamentals of Visual SLAM and perception systems for autonomous navigation.	**9 Hours**
PATH PLANNING AND APPLICATIONS Path planning algorithms including A* and Dijkstra methods, basics of motion planning, obstacle avoidance techniques, applications of autonomous navigation and SLAM in autonomous vehicles, drones and robotic systems.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Sebastian Thrun, Wolfram Burgard, and Dieter Fox, Probabilistic Robotics, MIT Press, 2005.
2. Roland Siegwart, Illah Reza Nourbakhsh, and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, 2nd Edition, MIT Press, 2011.

References

1. Juan-Antonio Fernández-Madrigal and José Luis Blanco Claraco, Simultaneous Localization and Mapping for Mobile Robots: Introduction and Methods, IGI Global, 2013.

2. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo, Robotics: Modelling, Planning and Control, Springer Nature, 2009.
Online Educational Resources:
1. MIT Visual Navigation for Autonomous Vehicles Course: https://vnav.mit.edu/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE023	AI for Autonomous Flight	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamentals of Artificial Intelligence applicable to autonomous flight systems.
2	To develop understanding of machine learning and deep learning methods for autonomous perception and decision-making.
3	To provide knowledge on guidance, navigation and control algorithms used in autonomous aerial vehicles.
4	To familiarize students with computer vision and sensor fusion pipelines for unmanned aerial systems.
5	To expose students to certification, safety, and ethical frameworks governing AI deployment in aviation.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamental principles of Artificial Intelligence and autonomous systems applicable to flight applications.	U
CO 2	Apply machine learning, deep learning, and neural network techniques for autonomous flight perception and decision-making.	Ap
CO 3	Analyze planning, guidance, and control algorithms used in autonomous aerial vehicles.	An
CO 4	Design AI-based perception and sensor-fusion pipelines for autonomous UAVs using computer vision.	Ap
CO 5	Evaluate certification, safety, and ethical frameworks governing AI deployment in civil and military aviation.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	2	3	-	-	-	-	-	2	3	2
2	3	3	2	3	3	-	-	-	-	-	2	3	3
3	3	3	2	2	3	-	-	-	-	-	2	3	3

4	3	3	3	2	3	-	-	-	-	-	2	3	3
5	3	3	2	2	2	2	2	-	-	-	3	2	2

Course Content	
AI FOUNDATIONS FOR AUTONOMOUS FLIGHT Introduction to Artificial Intelligence and autonomy concepts, levels of autonomy in aerial vehicles, knowledge representation, search and reasoning, intelligent agents, foundations of machine learning, and overview of autonomous flight architectures.	**9 Hours**
MACHINE LEARNING AND DEEP LEARNING FOR FLIGHT Supervised, unsupervised and reinforcement learning, neural networks and deep learning fundamentals, convolutional and recurrent architectures, training and validation, deep reinforcement learning for flight decision-making, transfer learning for aviation datasets.	**9 Hours**
AUTONOMOUS GUIDANCE, NAVIGATION AND CONTROL Path planning algorithms including A-star, RRT and Dijkstra, trajectory generation, model predictive control, adaptive control, learning-based control, fault-tolerant control, and AI-assisted guidance for autonomous UAVs and air taxis.	**9 Hours**
PERCEPTION AND COMPUTER VISION FOR UAVs Computer vision fundamentals, object detection and tracking, semantic segmentation, visual odometry, simultaneous localisation and mapping (SLAM), LiDAR and camera fusion, sense-and-avoid systems, and end-to-end perception pipelines for autonomous aircraft.	**9 Hours**
AI CERTIFICATION, SAFETY AND ETHICS IN AVIATION EASA and FAA guidelines on AI/ML in aviation, certification challenges of learning-enabled systems, run-time assurance, explainability, ethical AI principles, human-AI teaming, and case studies of autonomous aerial vehicle deployment and incidents.	**9 Hours**

Theory Hours: 45	**Tutorial Hours: 0**	**Practical Hours: 0**	**Project Hours: 0**	**Total Hours: 45**

Learning Resources

Textbooks

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2020.
2. Randal W. Beard and Timothy W. McLain, Small Unmanned Aircraft: Theory and Practice, Princeton University Press, 2012.

References

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
2. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, 2nd Edition, MIT Press, 2018.

3. Kimon P. Valavanis and George J. Vachtsevanos (Eds.), Handbook of Unmanned Aerial Vehicles, Springer, 2015.

Online Educational Resources:

1. NPTEL — Reinforcement Learning (IIT Madras): https://nptel.ac.in/courses/106106143

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE024	Estimation and Sensor Fusion Techniques	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamentals of probability theory and estimation techniques used in aerospace and autonomous systems.
2	To develop understanding of Kalman Filtering techniques for linear dynamic systems.
3	To provide knowledge on nonlinear estimation methods including EKF and UKF.
4	To familiarize students with sensor fusion architectures and multi-sensor data integration techniques.
5	To expose students to practical applications of estimation and sensor fusion in navigation, tracking, and UAV systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain probability theory, statistical measures, Bayes theorem, and estimation concepts used in engineering systems.	U
CO 2	Analyze linear dynamic systems using Kalman Filtering techniques for prediction and state estimation.	An
CO 3	Describe nonlinear estimation techniques including EKF, UKF, and linearization methods used in navigation systems.	U
CO 4	Explain sensor fusion architectures, multi-sensor integration techniques, and fusion algorithms used in autonomous systems.	U
CO 5	Evaluate estimation and sensor fusion applications in INS/GPS integration, target tracking, fault detection, and UAV navigation.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	1	1	-	-	-	-	-	2	2	1
2	3	3	1	2	3	-	-	-	-	-	2	3	3
3	3	3	2	2	3	-	-	-	-	-	2	3	3
4	3	3	2	2	3	-	-	-	-	-	2	3	3

5	3	3	2	2	3	-	-	-	-	-	2	3	3

Course Content	
PROBABILITY AND ESTIMATION BASICS Random variables and probability distributions, mean, variance and covariance, Bayes theorem, fundamentals of estimation theory including bias, consistency and statistical estimation concepts.	**9 Hours**
KALMAN FILTERING Linear system models, derivation of Kalman Filter equations, prediction and update steps in Kalman Filtering, applications of Kalman Filters in tracking and navigation systems.	**9 Hours**
NONLINEAR ESTIMATION Extended Kalman Filter (EKF), basics of Unscented Kalman Filter (UKF), linearization techniques and Jacobian matrices, applications of nonlinear estimation in INS/GPS integration systems.	**9 Hours**
SENSOR FUSION TECHNIQUES Data fusion architectures including centralized and decentralized fusion systems, multi-sensor fusion techniques, complementary filters, covariance intersection methods for sensor fusion and state estimation.	**9 Hours**
APPLICATIONS AND CASE STUDIES INS/GPS integration techniques, target tracking applications, fault detection methods, UAV navigation examples and real-world applications of estimation and sensor fusion systems.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Dan Simon, Optimal State Estimation: Kalman, H Infinity, And Nonlinear Approaches, John Wiley & Sons, 2006.
2. Mohinder S. Grewal and Angus P. Andrews, Kalman Filtering: Theory and Practice Using MATLAB, 4th Edition, John Wiley & Sons, 2015.

References

1. Andrew H. Jazwinski, Stochastic Processes and Filtering Theory, Dover Publications, 2007.
2. Simo Särkkä and Lennart Svensson, Bayesian Filtering and Smoothing, 2nd Edition, Cambridge University Press, 2023.
3. Arthur Gelb (Ed.), Applied Optimal Estimation, MIT Press, 1974.

Online Educational Resources:

1. YouTube – SLAM and Kalman Filter Lecture Series: https://www.youtube.com/playlist?list=PLgnQpQtFTOGQrZ4O5QzbIHgl3b1JHimN_

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE025	Digital Twins for Aerospace	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamentals of digital twin technology and its applications in aerospace systems.
2	To develop understanding of modelling, simulation, and real-time synchronization between physical and digital systems.
3	To provide knowledge on data acquisition, IoT and connectivity infrastructure for aerospace digital twins.
4	To familiarize students with AI and machine learning analytics for digital-twin-based predictive maintenance.
5	To expose students to industry case studies in aircraft, engine, manufacturing and fleet management digital twins.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain digital twin concepts, architectures, and lifecycle phases applicable to aerospace systems.	U
CO 2	Apply modelling and simulation techniques to develop digital representations of aircraft components and systems.	Ap
CO 3	Analyze IoT, data acquisition, and connectivity frameworks supporting digital twin operations in aerospace.	An
CO 4	Design predictive maintenance and structural health monitoring digital twins using AI and machine learning techniques.	Ap
CO 5	Evaluate aerospace digital twin applications in aircraft operations, manufacturing, MRO, and fleet management.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	1	3	-	-	-	-	-	2	2	3
2	3	3	2	2	3	-	-	-	-	-	2	3	3
3	3	3	2	3	3	-	-	-	-	-	2	3	3

4	3	3	3	2	3	2	-	-	-	-	2	3	3
5	3	3	2	2	3	2	-	-	-	2	3	2	3

Course Content	
FUNDAMENTALS OF DIGITAL TWINS Definition and history of digital twins, digital model vs digital shadow vs digital twin, NASA airframe digital twin concept, digital twin architectures including the 5-D model, lifecycle phases, and overview of aerospace use cases.	**9 Hours**
MODELLING AND SIMULATION FOR DIGITAL TWINS Physics-based modelling, finite element analysis, computational fluid dynamics, multi-body dynamics, reduced-order models for real-time simulation, co-simulation of subsystems, and integration of CAD/CAE tools for digital twin construction.	**9 Hours**
DATA ACQUISITION AND IoT INFRASTRUCTURE Sensor networks and aerospace IoT platforms, edge and cloud computing architectures, communication protocols including MQTT and OPC-UA, data ingestion pipelines, data storage and time-series databases, and cyber-security considerations for digital twins.	**9 Hours**
AI/ML ANALYTICS FOR DIGITAL TWINS Data-driven modelling using machine learning, anomaly detection, predictive maintenance algorithms, remaining useful life estimation, prognostics and health management, hybrid physics-ML models, and digital-twin-as-a-service platforms.	**9 Hours**
AEROSPACE DIGITAL TWIN APPLICATIONS Aircraft structural health monitoring digital twins, engine performance digital twins, manufacturing process digital twins, MRO and fleet management digital twins, and industry case studies from GE, Airbus, Boeing, Rolls-Royce and HAL.	**9 Hours**

Theory Hours: 45	**Tutorial Hours: 0**	**Practical Hours: 0**	**Project Hours: 0**	**Total Hours: 45**

Learning Resources

Textbooks

1. Nassim Khaled, Bibin Pattel and Affan Siddiqui, Digital Twin Development and Deployment on the Cloud, Academic Press, 2020.
2. Fei Tao, Meng Zhang and A. Y. C. Nee, Digital Twin Driven Smart Manufacturing, 1st Edition, Academic Press, 2019.

References

1. Michael Grieves, Digital Twin: Manufacturing Excellence through Virtual Factory Replication, LLC White Paper, 2014.
2. Anand Rajagopalan and Yogesh Wairagade, Digital Twins for Aerospace and Automotive, 1st Edition, Springer, 2023.

3. E. H. Glaessgen and D. Stargel, The Digital Twin Paradigm for Future NASA and US Air Force Vehicles, AIAA Paper 2012-1818, 2012.

Online Educational Resources:

1. NPTEL — Industry 4.0 and Industrial Internet of Things (IIT Kharagpur): https://nptel.ac.in/courses/106105195

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Mr. S. Muthukumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE026	Additive Manufacturing	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9			

Pre-requisite courses	24MEI101, 24AEP205	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To understand the fundamentals, process chain, and applications of additive manufacturing technologies.
2	To learn CAD modelling, reverse engineering, STL generation, and data preparation techniques for 3D printing.
3	To study construction, software, accuracy, and operational principles of 3D printers.
4	To analyze materials and major additive manufacturing processes including solid, liquid, and powder-based systems.
5	To evaluate advanced concepts, troubleshooting methods, industrial applications, and future trends in additive manufacturing.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain additive manufacturing principles, CAD integration, process chain, and reverse engineering concepts.	U
CO 2	Apply STL operations, slicing, orientation, and support generation techniques for 3D printing.	Ap
CO 3	Analyze construction, software, precision, and tolerance aspects of 3D printers.	An
CO 4	Examine materials and process workflows used in solid, liquid, and powder-based additive manufacturing systems.	An
CO 5	Evaluate applications, troubleshooting methods, advanced concepts, and future trends in additive manufacturing technologies.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	1	-	-	-	1	-	2	2	-
2	3	3	2	1	3	-	-	-	1	1	2	2	2
3	3	3	2	2	3	-	-	1	1	1	2	3	2
4	3	3	2	2	2	1	-	-	1	-	2	3	2
5	2	3	2	2	3	2	1	1	1	1	3	3	3

Course Content

Introduction to Additive Manufacturing and CAD Introduction to Additive Manufacturing (AM) processes – history and evolution – classification of AM technologies – applications of AM – Computer Aided Design (CAD) for additive manufacturing – design considerations for AM – file formats for AM (STL and others) – STL file generation – process chain for 3D printing – reverse engineering for 3D printing – scanning technologies and model reconstruction.	**9 Hours**
Data Preparation and 3D Printer Systems STL file format and associated operations – mesh repair and optimization – part orientation and build planning – support structure generation – slicing and tool path generation – constructional details of a 3D printer – printer components and working principles – accuracy, precision, and tolerance in 3D printing – calibration and quality considerations – 3D printing software workflow and build preparation systems.	**9 Hours**
3D Printing Materials and Solid-Based Processes Materials as building blocks for AM – material selection criteria – solid-based AM materials (thermoplastics, composites, sheets) – powder-based and liquid-based material overview – Fused Deposition Modelling (FDM) process – extrusion mechanisms and process parameters – FDM applications in engineering and healthcare – Sheet Lamination processes (LOM, UAM) – advantages, limitations, and applications – emerging trends in solid-based additive manufacturing.	**9 Hours**
Liquid-Based Additive Manufacturing Processes Introduction to liquid-based additive manufacturing – Vat Polymerization (classification only) – photo polymerization principles – Stereo lithography (SLA) process – SLA machine components and operation – SLA-based part fabrication – post-processing methods – curing and finishing operations – Digital	**9 Hours**

Light Processing (DLP) – Material Jetting (droplet-based photopolymer deposition) – process comparison and applications – future trends in liquid-based additive manufacturing.	
Powder-Based Additive Manufacturing Processes Powder characteristics and classification of powder-based additive manufacturing – Binder Jetting process and post-processing (curing, sintering, infiltration) – Selective Laser Sintering (SLS), Selective Laser Melting (SLM), Laser Powder Bed Fusion (LPBF) and Electron Beam Melting (EBM) – basic principles of powder bed fusion and process parameters – Direct Energy Deposition (DED) process including LENS system and applications – comparison of Binder Jetting, Powder Bed Fusion and DED based on process mechanism, material properties and applications – industrial applications in aerospace, automotive and biomedical fields – overview of emerging trends in additive manufacturing and Industry 4.0.	**9 Hours**

Theory	Tutorial	Practical	Project	Total
Hours: 45	**Hours: 0**	**Hours: 0**	**Hours: 0**	**Hours: 45**

Learning Resources

Textbooks

1. Ian Gibson, David Rosen & Brent Stucker, Additive Manufacturing Technologies (3rd Edition), Springer, New York, USA (2021).
2. Andreas Gebhardt & Jan-Steffen Hötter, Additive Manufacturing: 3D Printing for Prototyping and Manufacturing, Hanser Publishers, Munich, Germany (2016).
3. Chua C.K. & Leong K.F., 3D Printing and Additive Manufacturing: Principles and Applications (5th Edition), World Scientific Publishing, Singapore (2022).
4. Chee Kai Chua, Kah Fai Leong & Chu Sing Lim, Rapid Prototyping: Principles and Applications, World Scientific Publishing, Singapore (2010).
5. Frank W. Liou, Rapid Prototyping and Engineering Applications, CRC Press, Boca Raton, USA (2007).

References

1. Milan Brandt, Laser Additive Manufacturing: Materials, Design, Technologies and Applications, Woodhead Publishing, UK (2016).
2. Bikas H., Stavropoulos P. & Chryssolouris G., Additive Manufacturing Methods and Modelling Approaches, International Journal of Advanced Manufacturing Technology (2016).
3. Gibson I., Rosen D. & Stucker B., Design for Additive Manufacturing, Springer, New York, USA (2021).
4. Olaf Diegel, Axel Nordin & Damien Motte, A Practical Guide to Design for Additive Manufacturing, Springer, Singapore (2019).
5. Amit Bandyopadhyay & Susmita Bose, Additive Manufacturing, CRC Press, USA (2015).

Online Educational Resources:

1. NPTEL Courses on Additive Manufacturing and 3D Printing.
2. ASTM Additive Manufacturing Standards and Resources.
3. MIT OpenCourseWare – Additive Manufacturing Modules.
4. Ultimaker Academy and Autodesk Fusion 360 Learning Resources.
5. Coursera and edX Courses on 3D Printing Technologies.

6. America Makes – Additive Manufacturing Innovation Institute Resources.

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, CAD Modelling Exercises, Presentations, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Mr. R. Arun Kumar
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE027	AI & ML in Aviation	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce Artificial Intelligence and Machine Learning fundamentals in the context of the aviation industry.
2	To develop understanding of supervised, unsupervised, and reinforcement learning algorithms applied to aviation data.
3	To provide knowledge on predictive maintenance and prognostics for aircraft systems using AI and ML techniques.
4	To familiarize students with AI applications in air traffic management, flight operations and crew scheduling.
5	To expose students to data-driven decision-making, ethical and regulatory considerations in aviation AI.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain AI and ML principles and their applications across the aviation industry value chain.	U
CO 2	Apply supervised, unsupervised, and reinforcement learning algorithms to aviation datasets and operational data.	Ap
CO 3	Analyze predictive maintenance and prognostics strategies using AI and ML for aircraft systems and engines.	An
CO 4	Design AI-driven solutions for air traffic management, flight operations, fuel optimization and crew scheduling.	Ap
CO 5	Evaluate ethical, regulatory and safety implications of deploying AI and ML in commercial aviation.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	1	3	-	-	-	-	-	2	2	3
2	3	3	2	2	3	-	-	-	-	-	2	3	3
3	3	3	2	3	3	-	-	-	-	-	2	3	3

4	3	3	3	2	3	2	-	-	-	2	2	3	3
5	3	3	2	2	2	3	3	-	-	-	3	2	2

Course Content

AI/ML FUNDAMENTALS FOR AVIATION Overview of Artificial Intelligence and Machine Learning, aviation data sources including ACARS, ADS-B and FDR, data quality and preparation, exploratory data analysis, and introduction to Python and ML libraries used in aviation analytics.	**9 Hours**
MACHINE LEARNING ALGORITHMS FOR AVIATION DATA Regression and classification techniques, decision trees, random forests, support vector machines, clustering and dimensionality reduction, neural networks, deep learning, recurrent networks for time-series, and reinforcement learning applications in aviation.	**9 Hours**
PREDICTIVE MAINTENANCE AND PROGNOSTICS Condition-based maintenance, prognostics and health management framework, feature engineering from sensor data, remaining useful life estimation, anomaly detection algorithms, and case studies of engine and avionics predictive maintenance.	**9 Hours**
AI IN AIR TRAFFIC MANAGEMENT AND OPERATIONS Trajectory prediction, conflict detection and resolution, demand-capacity balancing, fuel-burn optimisation, crew scheduling, irregular operations recovery, dynamic pricing and revenue management, and AI-assisted decision support tools for airlines.	**9 Hours**
REGULATORY, ETHICAL AND SAFETY CONSIDERATIONS EASA and FAA guidance on AI in aviation, certification of learning-enabled functions, explainability and interpretability, bias and fairness in aviation AI, cyber-security of AI systems, and ethical frameworks for deploying AI in safety-critical operations.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow, 3rd Edition, O'Reilly Media, 2022.

References

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
2. EASA Artificial Intelligence Roadmap, 2nd Edition, European Union Aviation Safety Agency, 2023.
3. IATA, Artificial Intelligence in Aviation: Industry White Paper, International Air Transport Association, 2023.

Online Educational Resources:
1. NPTEL — Introduction to Machine Learning (IIT Madras): https://nptel.ac.in/courses/106106202

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-	-		Dr. S. Senthil Kumar, Dept. of Aero, KCT
Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE028	Manufacturing Technology for Aerospace	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce aerospace-specific manufacturing technologies, materials and supply chain considerations.
2	To develop understanding of metal forming, machining and joining processes for aircraft components.
3	To provide knowledge on composite material manufacturing and curing processes for aerospace structures.
4	To familiarize students with additive manufacturing workflows for aerospace prototypes and end-use parts.
5	To expose students to quality assurance, non-destructive testing and certification in aerospace manufacturing.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain aerospace manufacturing processes, material selection, and supply chain considerations.	U
CO 2	Apply metal forming, machining and joining processes for the fabrication of aircraft structural components.	Ap
CO 3	Analyze composite material manufacturing, layup techniques, and curing processes for aerospace structures.	An
CO 4	Design additive manufacturing workflows for aerospace prototypes and certified end-use components.	Ap
CO 5	Evaluate aerospace quality assurance, non-destructive testing, and certification frameworks.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	1	2	2	-	-	-	-	2	3	3
2	3	3	2	2	3	2	-	-	-	2	2	3	3
3	3	3	2	2	3	2	-	-	-	2	2	3	3

4	3	3	3	2	3	2	-	-	-	2	3	3	3
5	3	3	2	3	2	3	2	-	-	-	3	3	2

Course Content	
AEROSPACE MANUFACTURING FUNDAMENTALS Overview of aerospace manufacturing industry, classification of aerospace materials, material selection criteria, design for manufacturing principles, aerospace supply chain, and an introduction to lean manufacturing practices in aerospace production.	**9 Hours**
METAL MANUFACTURING PROCESSES Casting and forging of aerospace components, sheet metal forming, machining of aluminium and titanium alloys, super-plastic forming, welding and brazing, riveting and mechanical fastening, and surface treatments including anodizing and shot peening.	**9 Hours**
COMPOSITE MATERIALS MANUFACTURING Fibre reinforcements and matrix systems, prepreg layup, hand layup and resin transfer moulding, filament winding, autoclave and out-of-autoclave curing, composite machining and drilling, and sandwich panel manufacturing with honeycomb cores.	**9 Hours**
ADDITIVE MANUFACTURING IN AEROSPACE Overview of additive manufacturing technologies, selective laser melting and electron beam melting for metals, fused deposition modelling for polymers, design for additive manufacturing, post-processing operations, and certification of additively manufactured aerospace parts.	**9 Hours**
QUALITY ASSURANCE AND CERTIFICATION Quality management systems including AS9100, non-destructive testing methods such as ultrasonic, radiographic, eddy current and dye penetrant, statistical process control, first article inspection, and aerospace certification processes including DGCA, FAA and EASA requirements.	**9 Hours**

Theory Hours: 45	**Tutorial Hours: 0**	**Practical Hours: 0**	**Project Hours: 0**	**Total Hours: 45**

Learning Resources

Textbooks

1. Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, 8th Edition, Pearson, 2020.
2. Flake C. Campbell, Manufacturing Technology for Aerospace Structural Materials, Elsevier, 2006.

References

1. Flake C. Campbell, Manufacturing Processes for Advanced Composites, Elsevier, 2004.
2. Ian Gibson, David Rosen and Brent Stucker, Additive Manufacturing Technologies, 3rd Edition, Springer, 2021.

3. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, John Wiley and Sons, 2020.

Online Educational Resources:

1. NPTEL — Manufacturing Processes II (IIT Kanpur): https://nptel.ac.in/courses/112104195

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-		Mr. R. Arun Kumar

Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE029	Product Design and Development	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9 & 12			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand modern product development processes and organizational structures.
2	Identify customer needs and translate them into measurable product specifications.
3	Develop and evaluate product concepts using structured and data-driven methods.
4	Apply product architecture, industrial design, and design-for-manufacturing principles.
5	Plan prototyping, economic evaluation, and project management activities for successful product development.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze product development processes and organizational structures to identify challenges and opportunities in modern product development.	An
CO 2	Evaluate customer needs and product specifications using contemporary tools to prioritize and finalize requirements.	An
CO 3	Analyze and evaluate product concepts using customer feedback, concept screening, and scoring techniques.	An
CO 4	Examine product architecture and industrial design approaches to optimize manufacturability, sustainability, and product quality.	An
CO 5	Plan and manage prototyping, economic analysis, and project execution to ensure technically and commercially viable products.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	2	2	2	-	-	-	1	-	-	1	2	2	-
2	2	3	2	-	2	-	-	-	-	1	2	-	-
3	2	3	3	-	2	-	-	-	-	1	2	-	3
4	2	2	3	-	2	-	2	-	-	1	2	2	-
5	2	2	3	-	2	-	-	-	2	2	3	-	3

Course Content	
INTRODUCTION: DEVELOPMENT PROCESSES, ORGANIZATIONS & PRODUCT PLANNING Characteristics of successful product development in the context of global and digital markets, product development duration, cost, and risk, challenges in contemporary product development (complexity, sustainability, rapid innovation). Generic product development process, front-end concept development, agile and hybrid product development models, adapting development processes for startups and large organizations, modern product development organizations, cross-functional and distributed teams. Product planning process, opportunity identification using market and technology trends, project evaluation and prioritization, resource allocation and timeline planning, digital road-mapping tools, pre-project planning and continuous improvement.	**9 Hours**
IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS Customer discovery and voice-of-customer techniques, traditional and digital data collection methods (interviews, surveys, online analytics), interpreting customer data into needs, organizing needs hierarchically, prioritization using modern tools (QFD, Kano model), translating needs into engineering specifications, target specification setting, benchmarking, sustainability and regulatory considerations, final specification selection and validation.	**9 Hours**
CONCEPT GENERATION, SELECTION & CONCEPT TESTING Structured concept generation process, problem clarification, internal and external search including patents and digital repositories, systematic exploration using morphological charts, creativity tools and AI-assisted ideation, concept screening and scoring methods, risk and feasibility analysis. Concept testing objectives, survey design, digital prototyping for concept communication, measuring and analyzing customer response, interpreting results using data-driven approaches, iterative refinement.	**9 Hours**
PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN & DESIGN FOR MANUFACTURING Product architecture concepts and implications, modular vs integral architecture, platform planning and product families, supply chain and sustainability considerations, system-level design issues. Industrial design principles, human-centered and user-experience (UX) driven design, digital design tools, managing industrial design processes, evaluating industrial design quality. Design for Manufacturing and Assembly (DFMA), cost estimation using digital tools, reducing component and assembly costs, impact of DFM on quality, reliability, sustainability, and lifecycle performance.	**9 Hours**
PROTOTYPING, PRODUCT DEVELOPMENT ECONOMICS & PROJECT MANAGEMENT Prototyping fundamentals, physical and digital prototyping, rapid prototyping and additive manufacturing, planning prototype phases. Product development economics, base-case financial models, cost–benefit analysis, sensitivity and risk analysis, project trade-offs, qualitative factors influencing product success. Project management fundamentals, task representation tools, baseline planning, agile and hybrid project execution, accelerating projects, project monitoring, post-project evaluation and learning.	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources
Textbooks:
1. Karl Ulrich,T, Steven Eppinger, D, “Product Design and Development”, McGrawHill, 2015.

2. Chitale, AK, Gupta, RC, “Product Design and Manufacturing” PHI, 2013.
3. Timjones, “New Product Development:An Introduction to a multifunctional process”, Butterworth-Heinemann, 1997.
4. Geoffery Boothroyd, Peter Dewhurst and Winston Knight,A, “Product Design for Manufacture and Assembly”, CRC Press, 2011.

References:

1. Pahl, G., Beitz, W., Feldhusen, J., and Grote, K.-H., Engineering Design: A Systematic Approach, Springer, 2013.
2. Cooper, R. G., Winning at New Products, 4th Edition, Basic Books, 2019.
3. Baxter, M., Product Design: Practical Methods for the Systematic Development of New Products, CRC Press, 2015.

Online Educational Resources:

1. MIT OpenCourseWare – Product Design and Development
   https://ocw.mit.edu
2. NPTEL – Product Design & Development
   https://nptel.ac.in
3. IDEO Design Thinking Resources
   https://www.ideo.com
4. Coursera / edX – Digital Product Development & Innovation
   https://www.coursera.org | https://www.edx.org

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-		Dr. Naveen Kumar K
Recommended by BoS on		
Academic Council Approval	**Date**	

24AEE030	Product Lifecycle Management	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9, 11 & 12			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand modern Product Lifecycle Management concepts and enterprise-wide product data integration.
2	Learn PLM processes, workflows, and drivers supporting digital product development.
3	Understand collaborative product development and change management principles.
4	Analyze PLM system architecture and product information models.
5	Develop and evaluate PLM strategies aligned with organizational and digital transformation goals.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze product development processes and organizational structures to identify challenges and opportunities in modern product development.	An
CO 2	Evaluate customer needs and product specifications using contemporary tools to prioritize and finalize requirements.	An
CO 3	Analyze and evaluate product concepts using customer feedback, concept screening, and scoring techniques.	An
CO 4	Examine product architecture and industrial design approaches to optimize manufacturability, sustainability, and product quality.	An
CO 5	Plan and manage prototyping, economic analysis, and project execution to ensure technically and commercially viable products.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	2	-	1	2	1	1	-	1	2	2	-
2	2	3	2	1	2	-	-	-	1	1	2	2	-
3	2	3	3	1	2	-	-	-	1	1	2	2	2
4	2	2	3	1	2	2	2	2	-	1	2	2	2
5	2	2	3	1	2	1	1	1	2	3	3	3	3

Course Content	
INTRODUCTION TO PRODUCT LIFE CYCLE MANAGEMENT Definition, PLM Lifecycle Model, Threads of Product Lifecycle Management, Need for Product Lifecycle Management, Opportunities and Benefits of Product Lifecycle Management, Views, Components and Phases of Product Lifecycle Management, Product Lifecycle Management feasibility study, Product Lifecycle Management Visioning.	**9 Hours**
PLM CONCEPTS, PROCESSES AND WORKFLOW Characteristics of Product Lifecycle Management, Environment Driving Product Lifecycle Management, Product Lifecycle Management Elements, Drivers of Product Lifecycle Management, Conceptualization, Design, Development, Validation, Production, Support of Product Lifecycle Management.	**9 Hours**
COLLABORATIVE PRODUCT DEVELOPMENT Engineering Vaulting, Product Reuse, Smart Parts, Engineering Change Management, Bill of Materials and Process Consistency, Digital Mock-Up and Prototype Development, Design for Environment, Virtual Testing and Validation, Marketing Collateral.	**9 Hours**
SYSTEM ARCHITECTURE Introduction, Types of Product Data, Product Lifecycle Management systems, Features of Product Lifecycle Management System, System architecture, Product information models, Functionality of the Product Lifecycle Management Systems	**9 Hours**
DEVELOPING A PLM STRATEGY AND ASSESSMENT Strategy, Impact of strategy, implementing a PLM strategy, PLM Initiatives to Support Corporate Objectives, Infrastructure Assessment, Assessment of Current Systems and Applications**.**	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Michael Grieves, Product Lifecycle Management: Driving the Next Generation of Lean Thinking, Mc Graw Hill, 2015.
2. Martin Eigner, System Lifecycle Management – Engineering Digitalization (Engineering 4.0), Springer Vieweg 2021.
3. George E. Dieter and Linda C. Schmidt, Engineering Design, 5th Edition, McGraw-Hill Education, 2013.

References:

1. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, 7th Edition, McGraw-Hill Education, 2020.
2. Chitale, AK, Gupta, RC, “Product Design and Manufacturing” PHI, 2013.
3. Geoffery Boothroyd, Peter Dewhurst and Winston Knight,A, “Product Design for Manufacture and Assembly”, CRC Press, 2011.
4. Robert Hollins and Stuart Pugh, Successful Product Design and Development, Butterworth-Heinemann, 2019.

Online Educational Resources:

1. PTC – Product Lifecycle Management Resources
2. Autodesk Product Design & Manufacturing Collection
3. edX – Engineering Design and Product Development Courses

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-		Dr. Naveen Kumar K	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE031	Aerospace Certification and Standards	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamentals of aerospace certification processes and the roles of international regulatory authorities in ensuring airworthiness and safety.
2	To familiarize students with airworthiness regulations, certification specifications, and environmental standards applicable to aircraft systems and operations.
3	To develop understanding of certification requirements for aerospace structures, propulsion systems, avionics, and airborne software systems.
4	To impart knowledge of safety assessment methodologies, reliability analysis, and aerospace quality management standards.
5	To provide insight into aircraft and UAV certification procedures, testing, compliance verification, and documentation processes.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze the roles of aerospace regulatory authorities and certification procedures involved in ensuring aircraft airworthiness and operational safety.	An
CO 2	Interpret airworthiness regulations, certification specifications, and environmental standards applicable to aerospace systems.	Ap
CO 3	Evaluate certification requirements for aerospace structures, propulsion systems, avionics, and airborne software systems.	E
CO 4	Apply safety assessment methods and quality management standards to analyze reliability and risk in aerospace systems.	Ap
CO 5	Analyze aircraft and UAV certification processes including testing, compliance verification, and documentation procedures.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	-	-	-	-	-	-	2	3	-
2	3	3	-	-	-	-	-	-	-	-	2	3	-

3	3	3	2	1	-	-	-	-	-	-	2	3	-
4	2	3	2	2	-	-	-	-	-	-	2	3	-
5	3	3	2	2	-	-	-	-	-	-	2	3	-

Course Content

INTRODUCTION TO CERTIFICATION Overview of aerospace certification, importance of certification in aviation safety, regulatory framework, international and national regulatory bodies, FAA, EASA, DGCA, ICAO regulations, military certification authorities, type certificate, supplemental type certificate, production certificate, airworthiness certificate, operational approval process, certification documentation and compliance requirements.	**9 Hours**
AIRWORTHINESS STANDARDS Fundamentals of airworthiness standards, Federal Aviation Regulations (FAR), Certification Specifications (CS), military airworthiness requirements, structural and flight performance standards, environmental standards for aircraft noise and emissions, continuing airworthiness, maintenance and inspection regulations, safety compliance procedures and operational regulations.	**9 Hours**
SYSTEMS CERTIFICATION Certification requirements for aerospace systems, structural certification procedures, propulsion system certification, avionics certification, airborne electronic hardware standards, DO-178C software certification, DO-254 hardware certification, reliability and redundancy concepts, fault tolerance, system integration requirements and safety assessment considerations.	**9 Hours**
SAFETY AND QUALITY Safety assessment methodologies, Functional Hazard Assessment (FHA), Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA), Aerospace Recommended Practices (ARP), reliability engineering concepts, risk assessment methods, AS9100 quality management system, traceability, configuration management, documentation standards and aerospace safety culture.	**9 Hours**
CERTIFICATION PROCESS Certification planning and procedures, ground testing and flight testing, compliance verification methods, validation and qualification processes, certification reports and documentation, aircraft approval procedures, UAV certification frameworks, autonomous systems certification challenges, operational authorization and future trends in aerospace certification and standardization.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Dale Crane, Aviation Mechanic Series: Airframe Systems, Aviation Supplies & Academics, Inc., 2026.
2. Ian Moir, Allan Seabridge and Malcolm Jukes, Civil Avionics Systems, Second Edition, Wiley, 2013.

3. Stephen Corda, Introduction to Aerospace Engineering with a Flight Test Perspective, Second Edition, Wiley, 2025.

References

1. Mike Tooley, Filippo De Florio,John Watkinson, Pini Gurfil, Howard D. Curtis, Antonio Filippone, T. H. G. Megson, Michael V. Cook, P. W. Carpenter, E. L. Houghton, David Wyatt, Lloyd R. Jenkinson, and Jim Marchman, Aerospace Engineering Desk Reference, Butterworth-Heinemann, 2009.
2. Nicholas J. Bahr, System Safety Engineering and Risk Assessment: A Practical Approach, Second Edition, CRC Press, 2014.
3. Patrick D. T. O'Connor and Andre V. Kleyner, Practical Reliability Engineering, 6th Edition, Wiley, 2025.
4. Keith A. Rigby, Aircraft Systems Integration of Air-Launched Weapons, Wiley, 2013.

Online Educational Resources:

1. Federal Aviation Administration (FAA) Regulations and Certification Resources: https://www.faa.gov/regulations_policies
2. European Union Aviation Safety Agency (EASA) Certification Specifications: https://www.easa.europa.eu/en/document-library/certification-specifications
3. RTCA DO-178C Software Considerations in Airborne Systems: https://www.rtca.org/
4. SAE International Aerospace Standards (ARP/AS Standards): https://www.sae.org/standards/arp4761a-guidelines-conducting-safety-assessment-process-civil-aircraft-systems-equipment
5. DGCA India – Airworthiness and Certification: https://www.dgca.gov.in/digigov-portal/

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
-	-	Dr. S. Senthil Kumar, Dept. of Aero, KCT

Recommended by BoS on			
Academic Council Approval	No.	**Date**	

24AEE032	Aerospace NDT Methods and Practices	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9, 11 & 12			

Pre-requisite courses	24AET203	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the principles, need, and field of Non-Destructive Testing (NDT).
2	Learn the fundamental science behind commonly used NDT methods.
3	Apply appropriate NDT methods for defect detection and material characterization.
4	Interpret NDT results for quality assurance and structural integrity assessment.
5	Appreciate the role of NDT in safety-critical systems such as aircraft and industrial structures.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze the need, scope, and fundamental physics underlying non-destructive testing methods.	An
CO 2	Analyze radiographic inspection techniques and interpret radiographs for defect identification.	An
CO 3	Apply ultrasonic testing techniques to evaluate material properties and internal defects.	Ap
CO 4	Apply surface and electromagnetic NDT methods to detect discontinuities in materials.	Ap
CO 5	Analyze advanced NDT methods and select suitable techniques for engineering applications.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	2	2	2	1	-	2	2	-	2	3	2
2	3	3	2	2	3	1	-	2	2	-	2	3	2
3	3	3	3	2	3	2	-	2	2	-	2	3	3
4	3	3	3	2	3	2	-	2	2	-	2	3	3
5	3	3	2	3	3	2	1	2	2	-	2	3	3

Course Content	
INTRODUCTION AND FUNDAMENTALS OF NDT Definition, need and scope of NDT, destructive vs non-destructive evaluation, role of NDT in quality assurance and structural integrity, basic physics of NDT, wave propagation, electromagnetic phenomena, energy–matter interaction.	**8 Hours**
SURFACE AND ELECTROMAGNETIC METHODS Liquid penetrant testing: principles, equipment, procedures and safety; magnetic particle testing: magnetization methods, demagnetization, equipment and interpretation; eddy current testing: principles, influencing factors, instrumentation, calibration and applications.	**9 Hours**
RADIOGRAPHIC TESTING (RT) X-ray radiography principles and equipment, X-ray production, absorption and scattering, film processing, industrial radiography and micro-radiography, gamma-ray radiography, radiographic procedures, interpretation of radiographs, welding defects.	**9 Hours**
ULTRASONIC TESTING (UT) Principles of ultrasonic wave propagation, ultrasonic equipment, variables affecting UT, pulse-echo, pitch-catch and through-transmission techniques, A-scan, B-scan and C-scan, determination of elastic constants using ultrasonic velocity.	**9 Hours**
ADVANCED NDT METHODS AND APPLICATIONS Thermal/infrared inspection principles and applications, optical holography and interferometric techniques, acoustic emission testing and parameters, NDT selection criteria, applications in welds, composites, aircraft and industrial structures.	**10 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. B. Raj, T. Jayakumar and M. Thavasimuthu, Practical Non-Destructive Testing, Third Edition, Narosa Publishing House, New Delhi, 2012.
2. P. J. Shull (Ed.), Nondestructive Evaluation: Theory, Techniques and Applications, Second Edition, CRC Press, 2002.
3. G. S. Wasiuta and P. McIntire, *Non-Destructive Testing*, McGraw-Hill, 2011.

References:

1. D. S. Mishra, Introduction to Nondestructive Testing, Alpha Science International, 2016.
2. R. Halmshaw, Non-Destructive Testing, Third Edition, CRC Press, 1991.

Online Educational Resources:

1. NPTEL – Theory and Practice of Non-Destructive Testing (noc25_mm29)
   https://onlinecourses.nptel.ac.in/noc25_mm29
2. ASNT (American Society for Nondestructive Testing)
   https://www.asnt.org
3. TWI – NDT Training and Resources
   https://www.twi-global.com
4. NASA Technical Reports Server – NDT & Structural Integrity
   https://ntrs.nasa.gov

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-		Dr. Naveen Kumar K	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE033	Aerospace Technical Documentation	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 9 & 12			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:

The purpose of taking this course is to:

1	Understand the purpose, scope, and workflow of aerospace technical publications used in aircraft maintenance and safety.
2	Understand international aerospace technical publication standards and controlled technical language.
3	Gain knowledge of various aircraft maintenance, component, structural, and parts manuals.
4	Apply technical publications to interpret maintenance, inspection, and repair procedures.
5	Apply wiring diagrams and service documentation for aircraft troubleshooting and modification activities.

Course Outcomes

After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the role, importance, and workflow of aerospace technical publications in aircraft maintenance and airworthiness.	U
CO 2	Understand major aerospace technical publication standards such as ATA 100, ATA iSpec 2200, S1000D, and ASD-STE100.	U
CO 3	Apply aircraft maintenance and component manuals to understand maintenance, inspection, and repair procedures.	Ap
CO 4	Apply structural repair manuals, illustrated parts catalogues, and engineering drawings for aircraft configuration and repair activities.	Ap
CO 5	Apply wiring diagram manuals and service bulletins for aircraft troubleshooting and modification tasks.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	3	2	2	2	2	-	2	2	-	2	3	2
2	3	3	2	2	3	2	-	2	2	-	2	3	2
3	3	3	3	2	3	-	-	2	2	-	2	3	3
4	3	3	2	2	2	2	2	2	2	-	2	3	2
5	3	3	3	2	3	-	-	2	2	-	2	3	3

Course Content	
INTRODUCTION TO AEROSPACE TECHNICAL PUBLICATIONS Introduction to technical publications, definition and importance of technical publications in the aerospace industry, scope and applications, technical publication workflow and process, role of technical publications in aircraft maintenance, airworthiness, and safety.	**8 Hours**
TECHNICAL PUBLICATION STANDARDS Overview of aerospace documentation standards, purpose and classification of standards, civil and military publication standards, ATA 100, ATA iSpec 2200, S1000D specification, ASD-STE100 and their role in standardizing aerospace technical publications.	**10 Hours**
AIRCRAFT MAINTENANCE AND COMPONENT MANUALS Aircraft Maintenance Manual (AMM): definition, purpose, page block numbering, system description and maintenance practices; Component Maintenance Manual (CMM): structure, description and operation, testing and fault isolation, disassembly, repair, assembly, special tools, fixtures and illustrated parts list.	**9 Hours**
STRUCTURAL, PARTS AND ENGINEERING DOCUMENTATION Structural Repair Manual (SRM): allowable damage, standard repairs and structural identification; Aircraft Illustrated Parts Catalogue (AIPC): illustrations, catalog structure and indexing; engineering drawings: basics of engineering drawings, 2D and 3D drawings, bill of materials and interpretation of drawings.	**9 Hours**
WIRING DIAGRAMS AND SERVICE DOCUMENTATION Wiring Diagram Manual (WDM): wiring diagrams, schematics and wiring lists; service bulletins and service letters: purpose, types and applications; use of wiring and service documentation in aircraft maintenance, troubleshooting and modification.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Aviation Maintenance Technician Handbook: General – FAA-H-8083-30, Federal Aviation Administration, 2016. (Covers aircraft systems, maintenance documentation and publications basics.)
2. ATA Specification 2200 (iSpec 2200) – Air Transport Association, 2016.(Official industry standard for technical publication formats in civil aviation.)
3. S1000D Specification – S1000D Steering Committee, 2020. (International specification for development and management of technical publications.)
4. ASD-STE100 Simplified Technical English Standard – AeroSpace and Defence Industries Association of Europe, 2018. (Standard for controlled language applied to technical documentation.)

References:

1. Boeing 737 NG Aircraft Maintenance Manual (AMM) – The Boeing Company (Excerpts)
2. Airbus A320 Series AMM & IPC – Airbus (Excerpts)
3. Cessna 172S Skyhawk CMM & Wiring Manual – Textron Aviation (Excerpts)
4. Boeing 777 Illustrated Parts Catalogue (IPC) – The Boeing Company (Excerpts)
5. Boeing/Airbus Service Bulletins – Relevant issuances (Excerpts)

Online Educational Resources:

1. Air Transport Association (ATA) – iSpec 2200 Resource Page https://www.airlines.org
2. S1000D Specification Portal

https://www.s1000d.org
3. AeroSpace and Defence Industries Association of Europe (ASD) – STE100
   https://www.asd-ste100.org
4. NPTEL – Technical Communication / Standards (related theory and language standards)
   https://nptel.ac.in
5. FAA Technical Publications & Maintenance Library
   https://www.faa.gov/about/initiatives/maintenance_hf/library

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-		Dr. Naveen Kumar K	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE034	Aircraft Maintenance Repair and Overhaul	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	9			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce aircraft maintenance philosophy, airworthiness regulations and the MRO industry structure.
2	To develop understanding of line, base and component maintenance practices for transport aircraft.
3	To provide knowledge on inspection techniques, troubleshooting and repair procedures for aircraft systems.
4	To familiarize students with engine overhaul, avionics maintenance and aircraft structural repair processes.
5	To expose students to maintenance planning, reliability programmes and quality management in MRO operations.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain aircraft maintenance philosophy, airworthiness regulations and the global MRO industry structure.	U
CO 2	Apply line, base, and component maintenance procedures to ensure continued airworthiness of aircraft.	Ap
CO 3	Analyze inspection methods, troubleshooting techniques and repair procedures for aircraft systems and structures.	An
CO 4	Describe engine overhaul processes, avionics maintenance, and aircraft structural repair techniques.	U
CO 5	Evaluate maintenance planning, reliability programmes and quality management practices in MRO operations.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	1	2	2	2	-	-	-	2	3	2
2	3	3	2	2	3	2	2	-	-	2	2	3	3
3	3	3	2	3	3	2	2	-	-	2	2	3	3

4	3	3	2	2	3	2	2	-	-	2	2	3	3
5	3	3	2	2	3	3	3	-	-	3	3	3	3

Course Content	
AIRCRAFT MAINTENANCE PHILOSOPHY AND REGULATIONS Maintenance philosophy and objectives, hard time, on-condition and condition-monitoring concepts, maintenance steering group (MSG-3) logic, airworthiness regulations including DGCA CAR-145 and CAR-M, FAA Part 145 and EASA Part-145, MRO industry structure and approved maintenance organizations.	**9 Hours**
LINE, BASE AND COMPONENT MAINTENANCE Line maintenance activities and turn-around checks, transit, daily and weekly inspections, base maintenance including A, B, C and D checks, component shop maintenance, calibration of test equipment, hangar facilities, ground support equipment, and tooling requirements.	**9 Hours**
INSPECTION, TROUBLESHOOTING AND REPAIR Visual inspection techniques and non-destructive testing methods including dye penetrant, magnetic particle, ultrasonic, eddy current and radiographic inspection, fault isolation manuals, troubleshooting procedures, structural repair manual usage, and damage assessment of aircraft structures.	**9 Hours**
ENGINE OVERHAUL AND AVIONICS MAINTENANCE Engine performance monitoring and trend analysis, engine removal and installation, hot section inspection, modular overhaul concepts, engine test cell procedures, avionics line replaceable units, built-in test equipment, autopilot and communication systems maintenance, and cabin systems.	**9 Hours**
MAINTENANCE PLANNING AND QUALITY MANAGEMENT Maintenance planning documents and task cards, work package preparation, reliability programmes and statistical analysis, MEL and CDL applications, technical records and CAMO functions, human factors in maintenance, safety management systems, and quality assurance and audit processes.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Harry A. Kinnison and Tariq Siddiqui, Aviation Maintenance Management, 2nd Edition, McGraw-Hill, 2012.
2. Filippo De Florio, Airworthiness: An Introduction to Aircraft Certification and Operations, 3rd Edition, Butterworth-Heinemann, 2016.

References

1. Michael J. Kroes, William A. Watkins, Frank Delp and Ronald Sterkenburg, Aircraft Maintenance and Repair, 7th Edition, McGraw-Hill, 2013.
2. Federal Aviation Administration, Aviation Maintenance Technician Handbook — General FAA-H-8083-30A, US Department of Transportation, 2018.

3. Ian Moir and Allan Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, John Wiley and Sons, 2008.

Online Educational Resources:

1. NPTEL — Aircraft Maintenance: https://nptel.ac.in/courses/101106047

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
-		Mr. R. Arun Kumar	
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE035	Airport Planning and Air Traffic Control	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	11			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce airport planning principles, master planning process, and components of airport infrastructure.
2	To develop understanding of runway, taxiway, and apron geometric design based on aircraft categories.
3	To provide knowledge on terminal building planning, passenger flow, and baggage handling systems.
4	To familiarize students with air traffic control services, procedures, and communication systems.
5	To expose students to modern air traffic management technologies including CNS/ATM, ADS-B, and NextGen systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain airport planning fundamentals, master planning processes, ICAO standards and regulatory framework.	U
CO 2	Apply geometric design principles for runways, taxiways and aprons based on aircraft reference codes.	Ap
CO 3	Analyze terminal building layouts, passenger flow patterns, and baggage handling system configurations.	An
CO 4	Describe air traffic control services, separation standards, ATC procedures and aeronautical communication.	U
CO 5	Evaluate modern air traffic management systems including CNS/ATM, ADS-B, and performance-based navigation.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	1	2	2	-	-	-	-	2	2	2
2	3	3	3	2	3	2	-	-	-	2	2	3	3
3	3	3	2	2	2	3	-	-	-	2	2	2	2

4	3	2	-	2	2	2	-	-	-	-	2	2	2
5	3	3	2	3	3	3	2	-	-	2	3	3	3

Course Content	
AIRPORT PLANNING FUNDAMENTALS Components of an airport, types and classification of airports, airport site selection criteria, airport master planning process, ICAO Annex 14 standards, capacity analysis, environmental considerations, and an overview of airport authorities and regulatory framework in India and abroad.	**9 Hours**
AIRFIELD DESIGN Runway orientation and length determination, geometric design of runways, taxiways and aprons, runway and taxiway markings and lighting, pavement design considerations, drainage systems, obstacle limitation surfaces, and aircraft parking configurations.	**9 Hours**
AIRPORT TERMINAL AND LANDSIDE PLANNING Terminal building concepts and configurations, passenger flow analysis, baggage handling systems, check-in and security screening, arrival and departure facilities, ground transportation interface, parking facilities, cargo terminals, and airport landside planning.	**9 Hours**
AIR TRAFFIC CONTROL FUNDAMENTALS Air traffic services and classification of airspace, ATC towers and approach control, area control centres, separation standards, ATC clearances and procedures, instrument flight rules and visual flight rules, aeronautical communication, and ATC equipment.	**9 Hours**
MODERN AIR TRAFFIC MANAGEMENT SYSTEMS CNS/ATM concept covering communication, navigation and surveillance, ADS-B and ADS-C systems, performance-based navigation, automatic dependent surveillance, datalink communications, NextGen and SESAR programmes, and future trends including remote and digital towers.	**9 Hours**

Theory Hours:	**45**	**Tutorial Hours:**	**0**	**Practical Hours:**	**0**	**Project Hours:**	**0**	**Total Hours:**	**45**

Learning Resources

Textbooks

1. Robert Horonjeff, Francis X. McKelvey, William J. Sproule and Seth B. Young, Planning and Design of Airports, 5th Edition, McGraw-Hill, 2010.
2. Norman J. Ashford, Saleh A. Mumayiz and Paul H. Wright, Airport Engineering: Planning, Design and Development of 21st Century Airports, John Wiley and Sons, 2011.

References

1. International Civil Aviation Organization, Annex 14 Aerodromes Volume I: Aerodrome Design and Operations, 8th Edition, ICAO, 2018.
2. Michael S. Nolan, Fundamentals of Air Traffic Control, 5th Edition, Cengage Learning, 2010.

3. Saleh Mumayiz and Norman J. Ashford, Airport Operations, 3rd Edition, McGraw-Hill, 2013.
Online Educational Resources:
1. NPTEL — Airport Planning and Design (IIT Bombay): https://nptel.ac.in/courses/105101205

Assessment
SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Case Study, Presentation, End Semester Examination

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
-			Dr. J. Darshan Kumar
Recommended by BoS on			
Academic Council Approval		**Date**	

24AEE036	Space Technology & Satellite Systems	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4			

Pre-requisite courses	-	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is:	
1	To introduce the fundamentals of space technology, space environment, and satellite systems.
2	To provide knowledge on orbital mechanics and spacecraft orbital operations.
3	To develop understanding of launch vehicles, rocket propulsion, and spacecraft systems.
4	To familiarize students with major satellite subsystems and spacecraft integration concepts.
5	To expose students to satellite communication systems and space-based applications.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamentals of space technology, satellite systems, and space environment effects.	U
CO 2	Analyze orbital mechanics principles, orbital motion, and orbital maneuver techniques used in space missions.	An
CO 3	Describe launch vehicle systems, rocket propulsion fundamentals, spacecraft configuration, and mission profiles.	U
CO 4	Explain the functions and operations of major satellite subsystems including ADCS, TT&C, power, thermal, and propulsion systems.	U
CO 5	Evaluate satellite communication systems, link analysis, and applications of satellites in remote sensing, navigation, and weather monitoring.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)											Program Specific Outcomes (PSO)	
	1	2	3	4	5	6	7	8	9	10	11		
	Engineering Knowledge	Problem Analysis	Design/Development of Solutions	Conduct Investigations of Complex Problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project Management and Finance	Life-Long Learning	PSO-1	PSO-2
1	3	2	-	-	1	-	-	-	-	-	2	3	1
2	3	3	1	2	2	-	-	-	-	-	2	3	2
3	3	2	2	1	2	-	-	-	-	-	2	3	2
4	3	3	2	2	3	-	-	-	-	-	2	3	2
5	3	2	2	1	3	-	-	-	-	-	2	3	2

Course Content	
INTRODUCTION TO SPACE TECHNOLOGY AND SPACE ENVIRONMENT Evolution of space technology and major space missions, types of satellites including Low Earth Orbit (LEO), Medium Earth Orbit (MEO) and Geostationary Earth Orbit (GEO) satellites, space environment including vacuum conditions, radiation effects, micrometeoroids and thermal effects, space sustainability—orbital debris, the IADC 25-year LEO disposal guideline, collision avoidance, end-of-life de-orbit, overview of launch vehicles and space transportation systems, Indian launch vehicles.	**8 Hours**
ORBITAL MECHANICS Two-body problem and basic orbital motion, Kepler's laws of planetary motion, orbital elements and orbit determination, circular, elliptical and parabolic orbits, escape velocity and orbital velocity, orbital transfer and maneuver techniques, interplanetary and lunar trajectories.	**10 Hours**
LAUNCH VEHICLES AND SPACECRAFT SYSTEMS Fundamentals of rocket propulsion, classification of launch vehicles, staging concepts, launch sequence from lift-off to orbit insertion, mission profiles for satellite deployment, overview of launch vehicle subsystems: structures, propulsion, guidance, navigation, and control. Spacecraft configuration and architecture, subsystems: power generation and storage, thermal control, attitude determination and control, communication, and onboard data handling, payload integration and mission-specific configurations; introduction to spacecraft assembly, integration, and testing.	**9 Hours**
SATELLITE SUBSYSTEMS Structural subsystem, thermal control subsystem, electrical power subsystem, Attitude Determination and Control System (ADCS)—sensors (sun/star/earth, gyro, magnetometer) and actuators (reaction wheels, magnetorquers, thrusters), attitude representation, Telemetry Tracking and Command (TT&C) subsystem, propulsion subsystem, CubeSat standard.	**9 Hours**
SATELLITE COMMUNICATION AND APPLICATIONS Basics of satellite communication systems, uplink and downlink communication, transponders and satellite frequency bands, multiple access techniques, basics of satellite link budget analysis, applications of satellites in remote sensing, navigation and weather monitoring, principles of satellite navigation, GNSS, INSAT/GSAT, NavIC, GAGAN (SBAS).	**9 Hours**

Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	0	Project Hours:	0	Total Hours:	45

Learning Resources

Textbooks

1. Timothy Pratt, Charles Bostian, and Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley, 2017.
2. James R. Wertz and Wiley J. Larson, Space Mission Analysis and Design, 3rd Edition, Springer Nature, 1999.

3. Anil K. Maini and Varsha Agrawal, Satellite Technology: Principles and Applications, 3rd Edition, John Wiley & Sons, 2014.
4. Dennis Roddy, Satellite Communications, Fourth Edition, McGraw Hill, 2019.

References

1. Marshall H. Kaplan, Modern Spacecraft Dynamics and Control, Wiley, 2011.
2. Peter Fortescue (Ed.), Graham Swinerd (Ed.), John Stark (Ed.), Spacecraft Systems Engineering, 4th Edition, Wiley, 2011.

Online Educational Resources:

1. MIT OpenCourseWare – Satellite Engineering https://ocw.mit.edu/courses/16-851-satellite-engineering-fall-2003/

Assessment

SA I and SA II, MCQ, Assignments (FA) – Written Assignments, Presentation, End Semester Examination

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Dr. P. Sasikumar, Senior Scientist Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram	-	Dr. S. Senthil Kumar, Dept. of Aero, KCT

Recommended by BoS on	11.06.2026		
Academic Council Approval	No. 31	**Date**	19.06.2026