B.TECH

AERONAUTICAL ENGINEERING

ACADEMIC YEAR 2024-25

JOIN US TO NEW HEIGHTS IN AEROSPACE EXCELLENCE

IARE
INSTITUTE OF AERONAUTICAL ENGINEERING

NAAC ACCREDITATION A++ GRADE

NBA NATIONAL BOARD OF ACCREDITATION

nirf INDIA RANKINGS 2023 TOP 20 ENGINEERING RA 151-200 TOP 10 INNOVATION RANK 51-100

24 YEARS OF Excellence

VISION AND MISSION OF THE INSTITUTE

VISION

To bring forth students, professionally competent and socially progressive, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

VISION AND MISSION OF THE DEPARTMENT

VISION

To build a strong community of dedicated graduates with expertise in the field of aeronautical science and engineering suitable for industrial needs having a sense of responsibility, ethics and ready to participate in aerospace activities of national and global interest.

MISSION

The mission of Aeronautical Engineering is to actively participate in the technological, economic and social development of the nation through academic and professional contributions to aerospace and aviation areas, fostering academic excellence and scholarly learning among students of aeronautical engineering.

B.Tech

Program Educational Objectives (PEOs)

PEO-I

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

PEO-II

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

PEO-III

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

PEO-IV

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

Knowledge and Attitude Profile

WK1

A systematic, theory based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2

Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3

A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4

Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5

Knowledge, including emcient resource use, environmental impacts, whole-life cost,reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6

Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7

Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8

Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9

Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

B.Tech Program Outcomes (POs)

PO-1 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.

PO-2 Problem Analysis

Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO-3 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. (WK5)

PO-4 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. (WK8).

PO-5 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. (WK2 and WK6)

PO-6 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. (WK1, WK5, and WK7).

PO-7 Ethics

Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO-8 Individual and Collaborative Team work

Function efectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO-9 Communication

Communicate efectively and inclusively within the engineering community and society at large, such as being able to comprehend and write efective reports and design documentation, make efective presentations considering cultural, language, and learning diferences

PO-10 Project Management & 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 multi disciplinary environments.

PO-11 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. (WK8)

B.Tech Program Specific Outcomes (PSOs)

PSO-I

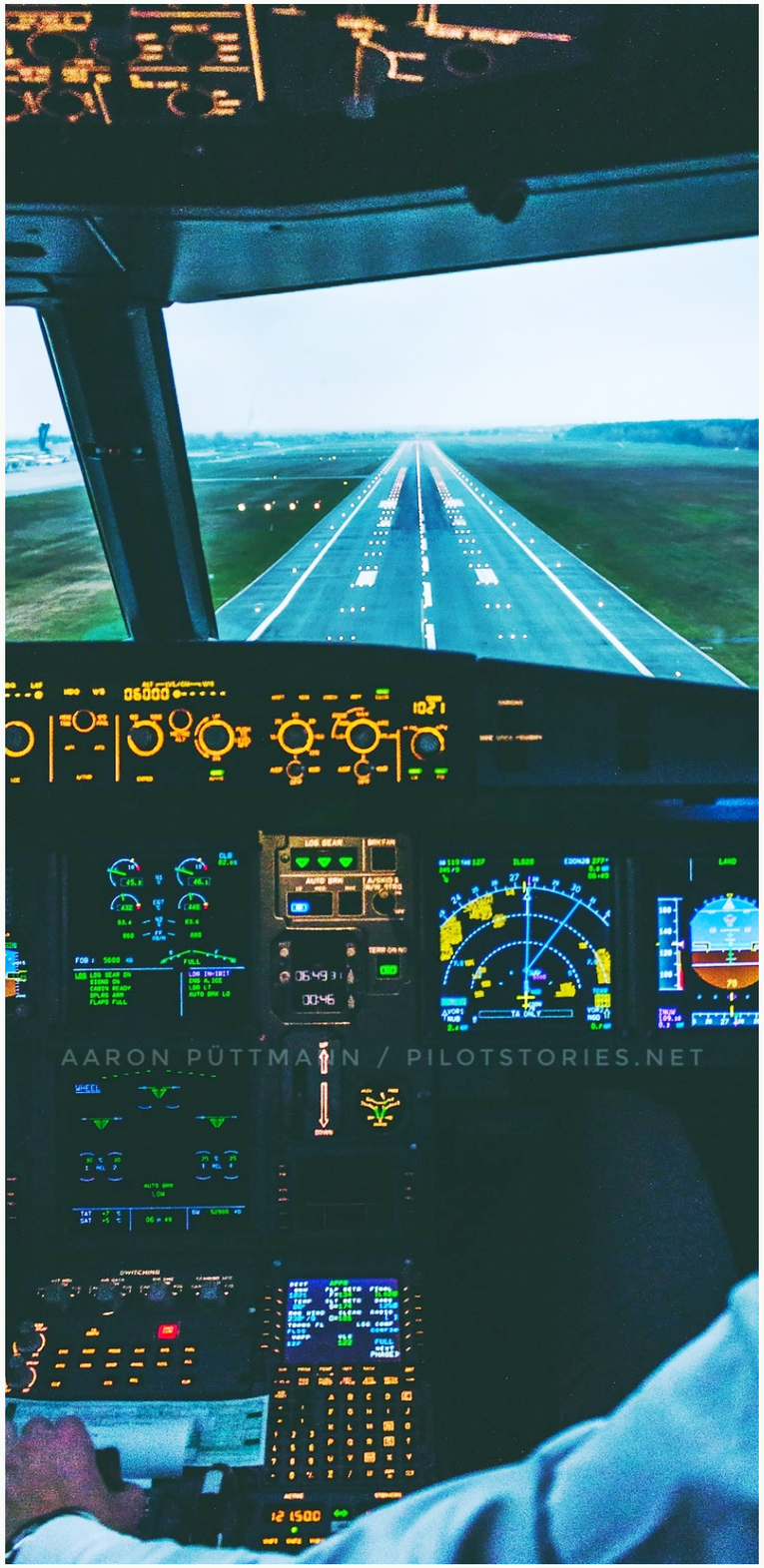
Build the prototype of UAVs and aero-foil models for testing by using low speed wind tunnel towards research in the area of experimental aerodynamics.

PSO-II

Focus on formulation and evaluation of aircraft elastic bodies for characterization of aero elastic phenomena.

PSO-III

Make use of multi physics, computational fluid dynamics and flight simulation tools for building career paths towards innovative startups, employability and higher studies.



ABOUT **AERONAUTICAL ENGINEERING**

Aeronautical engineering is the field of engineering that deals with the development of aircraft and spacecraft. It involves the study, design, and manufacturing of flight-capable machines, as well as the techniques of operating aircraft and rockets within the atmosphere.
Aeronautical Engineering is one of the most challenging fields of engineering with a wide scope for growth and career excellence.
It is a specialized branch of engineering focussed on the design, development, testing, and production of aircraft and related systems and equipment.

Why study Aeronautical Engineering @ IARE

.Well-equipped with modern laboratories and facilities that provide hands-on experience with the latest technologies for students.

.International Exposure for students via mobility program and student exchange.

.Strong ties with leading aerospace companies and organizations, offering students opportunities for internships, industrial training, and collaborative projects.

.Offers a robust curriculum that covers all essential aspects of aeronautical engineering.

.Latest techniques and practices in aeronautical Engineering will be taught and delivered to the students, along with the latest issues and developments in industry through exposure of offered courses.

.Strong alumni network of successful professionals working in various sectors of the aerospace industry.

.Provides a comprehensive and enriching educational experience.

.Encourages research and innovation among students and faculty. The institute hosts various research centers and provides resources to support cutting-edge research in aeronautical engineering.

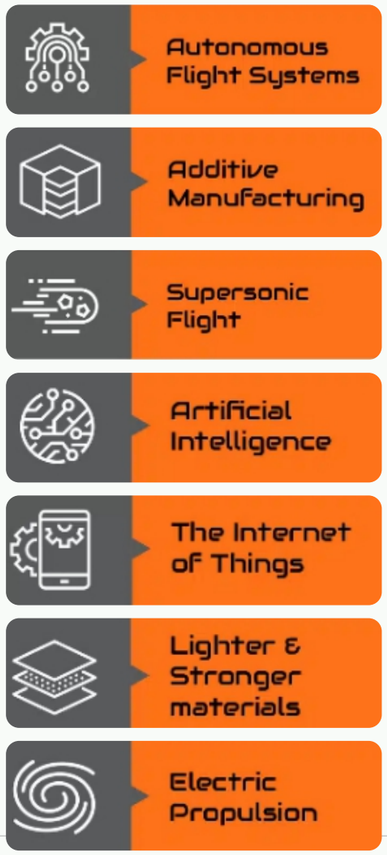
Emerging Trends and Technologies

Green Aviation: Development of sustainable technologies, including electric propulsion and alternative fuels.

UAVs and Drones: Expanding use of unmanned systems for commercial, military, and recreational applications.

Advanced Materials: Incorporation of nanotechnology and smart materials to enhance performance and safety.

Artificial Intelligence: Leveraging AI for autonomous flight, predictive maintenance, and enhanced avionics.



Expertise and focus:

.We are committed to quality and excellence in research, engaging in both fundamental and applied research that focus on real world problems or issues.

.We emphasize on creating new knowledge and innovative products that make impact to the society, academia, government, industry and environment.

Relevant high demands of research focus:

- Space Technology
- Rockets and Missiles
- Aerodynamics
- Nanotechnology
- Flight Simulation
- Gas Dynamics
- Aircraft Stability and Control
- Flight Vehicle Design
- Drone Technology

DEPARTMENT **SPECIFIC LABORATORIES**

The laboratories/research facilities are established in the department of Aeronautical Engineering. Various experimental setups are developed in these labs to crater to the need of B.Tech and M.Tech programs. In addition, several research facilities are also developed to support the research activities in the Department.

Aerodynamic research and development cell

The major activities under Aerodynamic and research development cell includes aero modeling, designing and fabrication of models. It sponsored Research and Development projects that lead to scientific research, engineering development and commercial production to transform knowledge into beneficial impacts.

Outcome

.Understanding of technology transfer processes and practices that lead to successful commercialization.

.Success in the transfer of technology products to the marketplace, into standards/ guidelines or other intended applications.

Flight Simulation Test Facility (FSTF)

Flight simulation laboratory hosts an engineering simulation based on simulink implementation of the equations of motion. Flight simulation is used for a variety of reasons, including flight training (mainly of pilots), the design and development of the aircraft itself, and research into flight dynamics and handling qualities. The use of flight simulators for training in complex and potentially dangerous situations (e.g. engine failure, systems failure, structural damage etc) is a critically important area in aircraft development.

Flight simulator

Flightrix single engine fixed base
Flight simulator based on C172R with Dual Cockpit
Cockpit live share
Make: AREXLABS
Model: FRX

Experimental Aerodynamics Test Facility (EATF)

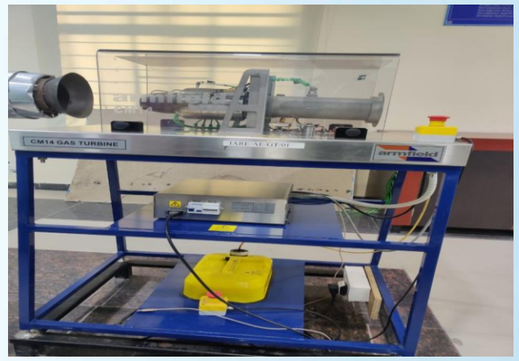
Aerodynamics is the epicenter of Aeronautical Engineering. Though the wave of Computational tools is still on a climb, Experiments are an irreplaceable tool to understand real world Aerodynamics. Experiments facilitate in understanding the real Physics by conducting tests on geometrically scaled models using the concept of dynamic similarity. Various techniques used in Experimental Aerodynamics include free flight tests, rocket sledge, Para-dropping, scaled model flying wind tunnel testing.

Specifications

Test Section size: 600 x 600 x 2000 mm
Maximum speed: 50m/s
Contraction ratio: 9
Honeycomb L/D: 8
Total Length of tunnel: 12 m
Make: Sunshine Measurements Pvt Ltd
Model: 2016

Gas Turbine Test Facility (GTTF)

The purpose of this laboratory exercise is to demonstrate basic turbojet principles using actual pressure, temperature, fuel flow and thrust measurements from a small turbojet.
The measurements available allow for the calculation of component efficiencies, compressor and turbine power, thrust, propulsive and thermal efficiency at various power settings.



Specifications

CM-14 GAS TURBINE - ENGINE SPECIFICATIONS
Make: ARMFIELD
Model: CM-14

Vibrations and Structural Dynamics Test Facility (VSDTF)

Experimental structural dynamics is a very important subject for certification and modification of aerospace structures. Using the equipment, the dynamic behaviour of the structure, in-terms of natural frequencies, mode shapes and damping values are obtained experimentally.

Specifications

Buckling of Structs
Make: TQ Equipments
Model: SM1005

Laboratory **Details**

1 Numerical Methods using MATLAB

Make: Intel
Model: Think Center Neo 50s
Configuration: 12th Generation Intel Core I5-12400 Processor, 16 GB DDR4 RAM, 512 GB SSD/ NO ODD, Bluetooth, WiFi, 22" Monitor, Keyboard, Mouse
Software Available: MATH WORKS-SIMULINK, MATLAB, EXCEL.

2 Mechanics of Solids & Fluid Dynamics Laboratory

Pelton turbine test rig
Make: Consolidated Engineering services
Model: 15 HP

Kaplan turbine test rig
Make: Consolidated Engineering services
Model: 15 HP

Francis turbine test rig
Make: Consolidated Engineering services
Model: 15 HP

Universal testing machine
Make: HITECH INDIA
Model: UTK-40

Computerized Universal Testing Machine
Make: HITECH INDIA
Model: UTK-40

Mechanical extensometer
Make: HITECH INDIA
Model: DVC

3 Aerospace Structures Laboratory

Beam deflection Test rig
Make: Edutech India Pvt Ltd
Model: SM1004

Unsymmetrical beam bending
Make: Edutech India Pvt Ltd
Model: STR77

Buckling of struts
Make: Edutech India Pvt Ltd
Model: SM1005

Vibration test equipment
Make: Spranktronics
Model: VMAS

4 Aerodynamics and Propulsion Laboratory

Subsonic wind tunnel
Specifications:
Test Section size: 600 x 600 x 2000 mm
Maximum speed: 50m/s
Contraction ratio: 9
Honeycomb L/D: 8
Total Length of tunnel: 12 m
Make: Sunshine Measurements Pvt Ltd

Propeller test rig
Make: Mechtrix Engineers
Model: Mechtrix Engineers

Cm14-a-axial flow gas turbine engine (bench mounting)
Make: HITECH INDIA
Model: CM14

Blower test rig
Make: Mechtrix Engineers
Model: 0.5HP

5 Aerospace Materials and Production Technology Laboratory

Milling machine
Make: Bharat Fritz Werner Ltd
Model: VF 2

Lathe machine
Make: Anil Engineering Works
Model: AGL-1

Surface grinding
Make: Voltas
Model: 540

6 Aircraft Production Drawing Laboratory

Make: Intel
Model: Think Center Neo 50s
Configuration: 12th Generation Intel Core I5-12400 Processor, 16 GB DDR4 RAM, 512 GB SSD/NO ODD, Bluetooth, WiFi, 22" Monitor, Keyboard, Mouse
Software Available: DASSAULT SYSTEM-CATIA V5R19

7 Computational Aerodynamics and Turbulence Modeling Laboratory

Make: Intel
Model: Think Center Neo 50s
Configuration: 12th Generation Intel Core I5-s 12400 Processor, 16 GB DDR4 RAM, 512 GB SSD/NO ODD, Bluetooth, WiFi, 22" Monitor, Keyboard, Mouse
Software Available: ANSYS-CFD, fluent

8 Computational Structure Laboratory

Make: Intel
Model: Think Center Neo 50s
Configuration: 12th Generation Intel Core I5-12400 Processor, 16 GB DDR4 RAM, 512 GB SSD/NO ODD, Bluetooth, WiFi, 22" Monitor, Keyboard, Mouse
Software Available: ANSYS-Structural, Thermal

9 Flight Vehicle Design Laboratory

Make: Intel
Model: Think Center Neo 50s
Configuration: 12th Generation Intel Core I5-12400 Processor, 16 GB DDR4 RAM, 512 GB SSD / NO ODD, Bluetooth, WiFi, 22" Monitor, Keyboard, Mouse
Software Available: MATH WORKS-SIMULINK, MATLAB, EXCEL

10 Aerospace Structural Dynamics Laboratory

Universal Vibration apparatus
Make: Scientific Enterprises
Model: Scientific Enterprises

Journal Bearing apparatus
Make: Scientific Enterprises
Model: Scientific Enterprises

Mechanism models
Make: Scientific Enterprises
Model: Scientific Enterprises

FACULTY **INFORMATION**

Dr. B D Y Sunil

Head of the Department

Ph.D (2019), Doctoral Degree, JNTUH, Hyderabad
M.Tech (2010), JNTUH, Hyderabad
B.Tech (2005), JNTUH, Hyderabad

AREA OF SPECIALIZATION
Design for Manufacturing, Production

Dr. Yagya Dutta Dwivedi

Associate Professor & Deputy Head

Ph.D (2018),Doctoral Degree, Vignan's Foundation for Science (Deemed to be University), Guntur
M.Tech (2013), JNTUH, Hyderabad
B.E (2000), Naval Institute of Aeronautical Technology, Kochi, Kerala

AREA OF SPECIALIZATION
Stability and control , Flapping Wing Aerodynamics

Dr. D Govardhan

Professor

Ph.D (2012),Doctoral Degree, JNTUH, Hyderabad
M.Tech (2000), JNTUH, Hyderabad
B.E (1988), Osmania University, Hyderabad

AREA OF SPECIALIZATION
Manufacturing, production technology,
Aircraft structures

Dr. Prasanta Kumar Mohanta

Professor

Ph.D (2017),Doctoral Degree, Anna University, Chennai, Tamil Nadu
M.Tech (1989), Birla Institute of Technology Mesra, Jharkhand
B.E (1987), Aeronautical Society of India, Delhi

AREA OF SPECIALIZATION
Space Engineering & Rocketry, Aerodynamics

Dr. K Maruthupandiyan

Associate Professor

Ph.D (2018),Doctoral Degree, Indian Institute of Technology Kanpur, UP
M.Tech (2013), Anna University, Chennai, Tamil Nadu
B.E (2011), Anna University, Chennai, Tamil Nadu

AREA OF SPECIALIZATION
High Speed Aerodynamics, Shockwaves and Computational Fluid Dynamics

Dr. Praveen Kumar Balguri

Associate Professor

Ph.D (2019), Doctoral Degree, Hindustan University, Chennai, Tamil Nadu
M.Tech (2009), Indian Institute of Technology Madras, Chennai, Tamil Nadu
B.Tech (2005), JNTUH, Hyderabad

AREA OF SPECIALIZATION
Polymer Nanocomposites, Aircraft structures

Dr. Dr. B Aslesha

Assistant Professor

Ph.D (2021), University of Petroleum & Energy Studies, Dehradun, Uttarakhand
M.Tech (2015), University of Petroleum & Energy Studies, Dehradun, Uttarakhand
B.Tech (2013), JNTUH, Hyderabad

AREA OF SPECIALIZATION
Computational Fluid Dynamics, Aircraft structures, Aerodynamics

Dr. S Devaraj

Assistant Professor

Ph.D (2023), Vignan's Foundation for Science (Deemed to be University), Guntur, AP
M.Tech (2012), JNTUH, Hyderabad
B.Tech (2009), JNTUH, Hyderabad

AREA OF SPECIALIZATION
Finite Element Analysis, Aircraft structures

Assistant **Professors**

Ms. G Sravanthi

Ms. D Anitha

Mr. Rathan Babu

Mr. V Phanider Reddy,

Mr. Ch Sai Krishna

Mr. G Shiva Krishna

Mr. K Arun Kumar

Mrs. D Karuna Kumari

Mr. P Dilleswara Rao

Knowledge **on Aeronautical Engineering**

Aeronautical engineering VS aerospace engineering

Aeronautical Engineering primarily deals with the design, development, testing, and maintenance of aircraft, including airplanes, helicopters, and unmanned aerial vehicles (UAVs). Aeronautical engineers work on aerodynamics, propulsion systems, materials, structures, and control systems specific to vehicles that operate within Earth's atmosphere.

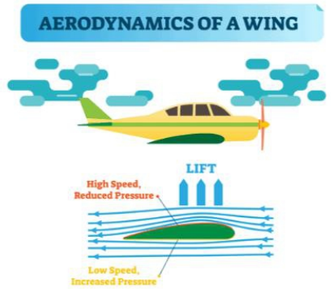
On the other hand, Aerospace Engineering encompasses a broader scope that includes not only aircraft but also spacecraft, such as satellites, rockets, and space exploration vehicles like the Space Shuttle and Mars rovers.

Aeronautical Domain with applications

Aeronautical Engineering can be broadly categorized into several domains and subdomains, each focusing on different aspects of aircraft design, operation, and maintenance.

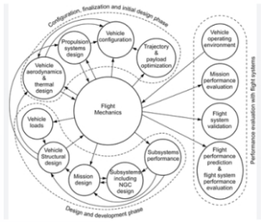
Aerodynamics

·Subsonic Aerodynamics: Designing commercial airliners for fuel efficiency.
·Transonic Aerodynamics: Developing fighter jets capable of high-speed maneuvers.
·Supersonic Aerodynamics: Designing supersonic passenger aircraft for faster travel.
·Hypersonic Aerodynamics: Developing hypersonic vehicles for military and space exploration purposes.



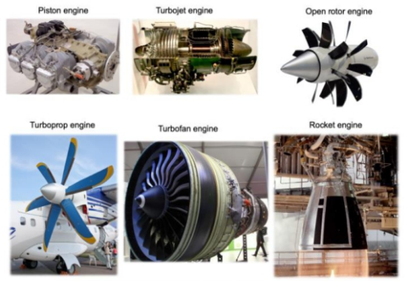
Flight Mechanics

·Aircraft Performance: Optimizing takeoff and landing distances for commercial aircraft.
·Stability and Control: Designing control systems to maintain stability during flight.
·Flight Dynamics: Studying aircraft behaviour in different flight conditions for safety and performance improvements.



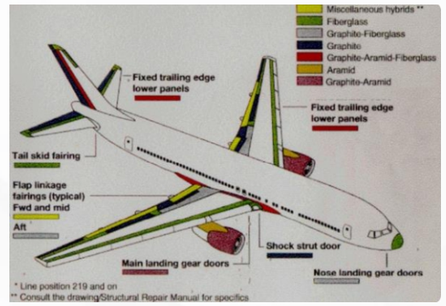
Propulsion

·Jet Propulsion: Powering commercial airliners with turbofan engines.
·Rocket Propulsion: Launching satellites and spacecraft into orbit.
·Gas Turbine Engines: Providing thrust for military aircraft and business jets.
·Piston Engines: Powering small general aviation aircraft and helicopters.



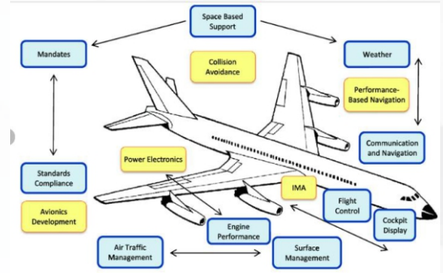
Structures and Materials

·Structural Analysis: Ensuring the integrity of aircraft structures under various loads.
·Composite Materials: Developing lightweight and strong materials for aircraft components.
·Fatigue and Fracture Mechanics: Predicting and preventing structural failures due to cyclic loading.
·Aeroelasticity: Studying the interaction between aerodynamics and structural dynamics to prevent flutter and other instabilities.



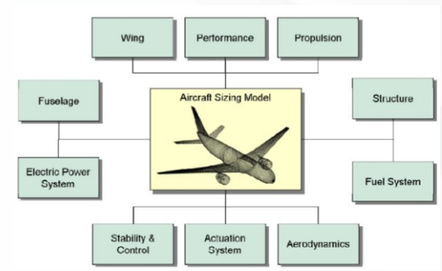
Avionics

·Flight Control Systems: Implementing fly-by-wire systems for precise aircraft control.
·Navigation Systems: Developing GPS and inertial navigation systems for accurate positioning.
·Communication Systems: Enabling communication between aircraft and air traffic control.
·Instrumentation: Monitoring aircraft parameters for safety and performance.



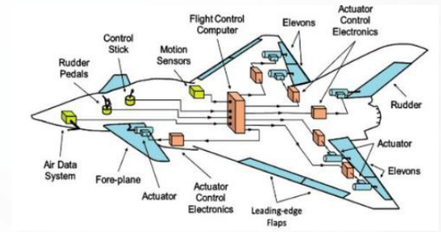
Aircraft Design

·Conceptual Design: Creating initial aircraft configurations based on mission requirements.
·Preliminary Design: Refining aircraft concepts and performing feasibility studies.
·Detailed Design: Engineering specific components and systems for production.
·Optimization Techniques: Fine-tuning aircraft designs for improved performance, efficiency, and cost-effectiveness.



Aircraft Systems

·Environmental Control Systems: Regulating cabin temperature and air quality for passenger comfort.
·Landing Gear Systems: Ensuring safe takeoff and landing operations.
·Hydraulic and Pneumatic Systems: Powering aircraft control surfaces and landing gear.
·Electrical Systems: Providing power for onboard systems and instrumentation.



Aerospace Manufacturing

·Manufacturing Processes: Using CNC machining and additive manufacturing for producing aircraft components.
·Quality Assurance: Ensuring compliance with industry standards and regulations.
·Automation and Robotics: Implementing robotic assembly lines for increased efficiency and precision.
·Additive Manufacturing (3D Printing): Producing complex parts with reduced material waste.

Safety and Reliability

·Failure Analysis: Investigating accidents and incidents to identify root causes and prevent recurrence.
·Risk Assessment: Analyzing potential hazards and mitigating risks in aircraft operations.
·Safety Regulations: Ensuring compliance with aviation authorities' regulations to maintain airworthiness.
·Human Factors Engineering: Designing cockpit layouts and procedures to enhance pilot performance and safety.

Aircraft Maintenance and Repair

·Routine Maintenance: Conducting scheduled inspections and servicing to ensure aircraft reliability.
·Troubleshooting: Diagnosing and rectifying mechanical and electrical faults to minimize downtime.
·Overhaul and Repair: Performing major maintenance tasks to extend the lifespan of aircraft components.
·Structural Integrity Monitoring: Using non-destructive testing techniques to assess the condition of aircraft structures and identify potential defects.

Career Prospectus in Aeronautical Engineering

Aeronautical engineering offers a wide range of career prospects in both the aerospace and aviation industries. Here are some of the key career paths available to aeronautical engineers

Aircraft Design and Manufacturing: Aeronautical engineers can work for aircraft manufacturers, where they are involved in designing, developing, and testing new aircraft. This involves working on aerodynamics, propulsion systems, materials, structures, and avionics.

Aircraft Maintenance and Repair: Aeronautical engineers can also work in aircraft maintenance and repair facilities, ensuring that aircraft are properly maintained, serviced, and repaired to meet safety standards and regulatory requirements.

Aerospace Research and Development: Aeronautical engineers can work in research and development organizations, both in the private sector and in government agencies, where they conduct research to develop new technologies and improve existing aerospace systems.

Flight Testing: Aeronautical engineers may work as flight test engineers, conducting tests on aircraft to evaluate their performance, handling characteristics, and safety.

Aerospace Systems Integration: Aeronautical engineers can work in systems integration, where they are responsible for integrating various components and subsystems into a complete aerospace system, such as an aircraft or spacecraft.

Aerospace Consulting: Aeronautical engineers can work as consultants, providing technical expertise and advice to aerospace companies, government agencies, and other organizations.

Air Traffic Control and Management: Some aeronautical engineers may work in air traffic control and management, where they are involved in managing air traffic, ensuring safe and efficient operation of the airspace system.

Unmanned Aerial Vehicles (UAVs): With the increasing use of UAVs for various applications, aeronautical engineers can also work in the design, development, and operation of unmanned aerial vehicles for military, commercial, and civilian purposes.

COURSE MENU

Curriculum is designed based on professional modules from ISRO, DRDO, HAL, BDL, TATA Advance systems, Saffron, GE Aerospace, Honeywell Aerospace and AICTE Model Curriculum in several subjects and so that students have opportunity to obtain professional certificates from the companies upon graduation.

TATA

TATA ADVANCED SYSTEMS

HAL

SAFRAN

GE Aerospace

DRDO

इसरो ISRO

भारत डायनामिक्स लिमिटेड
BHARAT DYNAMICS LIMITED

I SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AHSD01	Professional Communication	3	English
AHSD02	Matrices and Calculus	4	Mathematics
AEED01	Elements of Electrical and Electronics Engineering	3	Physics
ACSD01	Object Oriented Programming	3	---
PRACTICAL			
AHSD04	Professional Communication Laboratory	1	Professional Communication
AEED03	Electrical and Electronics Engineering Laboratory	1	Elements of Electrical and Electronics Engineering
ACSD02	Object Oriented Programming with Java Laboratory	2	Object Oriented Programming
AMED01	Engineering Workshop	2	---
EXPERIENTIAL ENGINEERING EDUCATION (ExEED)			
ACSD03	Essentials of Innovation	1	
MANDATORY COURSE			
AHSD06	Environmental Science	MC	MC - I
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**20**	

II Semester			
THEORY			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AHSD03	Engineering Chemistry	3	Chemistry
AHSD07	Applied Physics	3	Physics
AHSD08	Differential Equations and Vect or Calculus	4	Mathematics
AMED04	Engineering Mechanics	3	---
PRACTICAL			
AHSD05	Engineering Chemistry Laboratory	1	Engineering Chemistry
AHSD09	Applied Physics Laboratory	1	Applied Physics
AMED05	Computer Aided Engineering Drawing	2	---
ACSD06	Programming for Problem Solving Laboratory	2	---
EXPERIENTIAL ENGINEERING EDUCATION (ExEED)			
ACSD07	Mobile and Web Applications Development	2	---
MANDATORY COURSE			
AHSD10	Gender Sensitization	MC	MC - II
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**40**	

III SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AHSD11	Probability and Statistics	4	Mathematics
AAED01	Mechanics of Solids	3	Engineering Mechanics
AAED02	Thermodynamics and Heat Transfer	3	Applied Physics
AAED03	Fluid Dynamics	3	---
ACSD08	Mechanics of Solids	3	---
PRACTICAL			
AAED04	Numerical Methods using MATLAB	1	---
AAED05	Mechanics of Solids & Fluid Dynamics Laboratory	1	Mechanics of Solids
ACSD11	Data Structures Laboratory	1	Mechanics of Solids
EXPERIENTIAL ENGINEERING EDUCATION (ExEED)			
ACSD12	Prototype and Design Building	1	---
VALUE ADDED COURSE			
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**60**	

IV SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AAED06	Aircraft Structures	3	Mechanics of Solids
AAED07	Aircraft Propulsion and Turbomachinery	3	Thermodynamics and Heat Transfer
AAED08	Aerodynamics	3	Fluid Dynamics
AAED09	Flight Mechanics	3	Engineering Mechanics
AAED10	Aerospace Materials and Production Technology	3	Manufacturing Practice
PRACTICAL			
AAED11	Aerospace Structures Laboratory	1	Aircraft Structures
AAED12	Aerodynamics and Propulsion Laboratory	1	Aerodynamics
AAED13	Aerospace Materials and Production Technology Laboratory	1	Aerospace Materials and Production Technology
SKILL ENHANCEMENT PROJECT			
ACSD18	DevOps Engineer	2	---
VALUE ADDED COURSE			
INTERNSHIP			
	TOTAL	**20**	
	CUMULATIVE CREDITS	**80**	

V SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AAED14	Artificial Intelligence for Aerospace Engineering	3	
AAED15	Aerospace Propulsion	3	Aircraft Propulsion and Turbomachinery
AAED16	Analysis of Aircraft Structures	3	Aircraft Structures
AAED17	Gas Dynamics	3	Aerodynamics
	Program Elective – I	3	---
PRACTICAL			
AAED23	Aircraft Production Drawing Laboratory	1	---
AAED24	Computer Aided Manufacturing Laboratory	1	---
SKILL ENHANCEMENT PROJECT			
	Skill #	2	
	Engineering Design Project	1	
VALUE ADDED COURSE			
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**100**	

VI SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AAED25	Computational Aerodynamics and Turbulence Modeling	3	Aerodynamics, Gas Dynamics
AAED26	Finite Element Analysis	3	Aircraft Structures
	Program Elective – II	3	---
	Program Elective – III	3	---
	Open Elective – I	3	---
PRACTICAL			
AAED39	Computational Aerodynamics and Turbulence Modeling Laboratory	1	Computational Aerodynamics and Turbulence Modeling
AAED40	Computational Structure Laboratory	1	Finite Element Analysis
SKILL ENHANCEMENT PROJECT			
	Skill Enhancement #	2	---
	Development Project	1	---
VALUE ADDED COURSE			
INTERNSHIP			
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**120**	

VII SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AAED41	Flight Vehicle Design	3	Aerodynamics, Aircraft Structures
AAED42	Aerospace Structural Dynamics	3	Aircraft Structures
	Program Elective – IV	3	---
	Program Elective – V	3	---
	Open Elective – II	3	---
PRACTICAL			
AAED55	Flight Vehicle Design Laboratory	1	Flight Vehicle Design
AAED56	Aerospace Structural Dynamics Laboratory	1	Aerospace Structural Dynamics
PROJECT WORK			
AAED57	Project Work (Phase - I)	3	---
MANDATORY COURSE			
AHSD14	Essence of Indian Traditional Knowledge	MC-2	MC
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**140**	

VIII SEMESTER			
Course Code	**Course Name**	**Credits**	**Prerequisites**
THEORY			
AHSD15	Managerial Economics and Financial Analysis	3	---
	Program Elective - VI	3	---
	Open Elective-III	3	---
PROJECT WORK			
AAED65	Project Work (Phase - II)	11	
	TOTAL CREDITS	**20**	
	CUMULATIVE CREDITS	**160**	

ELECTIVE **COURSES**

PROGRAM ELECTIVES COURSES (PEC)

The below listed courses are Professional electives and the student has to study six courses as professional electives

Course Code	Name of the Course	Prerequisites	Preferred Semester	Credits
AAED18	Heat and Mass Transfer	Thermodynamics	V	3
AAED19	Mechanism and Machine Design	Mechanics of Solids	V	3
AAED20	CAE/CAM	Aerospace Materials and Production Technology	V	3
AAED21	Aircraft Systems and Control	Introduction to Aerospace Engineering	V	3
AAED22	Space Dynamics	Aerodynamics	V	3
AAED27	Aircraft Systems and Instrumentation	Aircraft Performance	VI	3
AAED28	Rocket and Missile Technology	Aerospace Propulsion	VI	3
AAED29	Techniques in Wind Tunnel Testing	Fluid Dynamics	VI	3
AAED30	Fatigue and Fracture of Materials	Aircraft Structures	VI	3
AAED31	Orbital Mechanics	Aircraft Propulsion	VI	3
AAED32	Turbo Machinery	Fluid Dynamics	VI	3
AAED33	Introduction to Composite Materials	Aerospace Materials and Production Technology	VI	3
AAED34	Theory of Stress Strain Measurements	Aircraft Structures	VI	3
AAED35	High Temperature Gas Dynamics	Gas Dynamics	VI	3
AAED36	Gas Turbines and Jet Propulsion Technology	Aircraft Propulsion	VI	3
AAED43	Computational Fluid Dynamics	Aerodynamics	VII	3
AAED44	Unmanned Air Vehicles	Fluid Dynamics	VII	3
AAED45	Air Transportation System	Introduction to Aerospace Engineering	VII	3
AAED46	Hypersonic Aerodynamics	Gas Dynamics	VII	3
AAED47	Ground Vehicle Aerodynamics	Aerodynamics	VII	3
AAED48	Theory of Aeroelasticity	Aircraft Structures	VII	3
AAED49	Avionics and Instrumentation	Elements of Electrical and Electronics Engineering	VII	3
AAED50	Automatic Control of Aircraft	Aircraft Stability and Control	VII	3
AAED51	Helicopter Aerodynamics	Aerodynamics	VII	3
AAED52	Introduction to Nano Technology	Aerospace Materials and Production Technology	VII	3
AAED58	Flight Scheduling and Operations	Introduction to Aerospace Engineering	VIII	3
AAED59	Non Destructive Testing	Aerospace Materials and Production Technology	VIII	3
AAED60	Engineering Optimization Techniques	Probability and Statistics	VIII	3
AAED61	Molecular Gas Dynamics	Gas Dynamics	VIII	3
AAED62	Aircraft Maintenance Engineering	Introduction to Aerospace Engineering	VIII	3

Open Elective Courses (OEC)

The courses listed below are offered by the Department of Electrical and Electronics Engineering for students of other departments.

Course Code	Course Name	Credits
AAED37	Elements of Aerospace Engineering	3
AAED38	Fundamentals of drones	3
AAED53	Jet Propulsion	3
AAED54	Aircraft Production Technology	3
AAED63	Avionics Systems	3
AAED64	Space Flight	3

Value-added Courses

Objective

Value added courses are provided to equip the students with knowledge and skills outside of the curriculum or to meet any specific requirements of the industry. The following are the Value- Added Courses provided to students by various departments in our institution.

ARE ELRV – AKANKSHA / CERTIFICATE - SWAYAM, e-PG pathshala, NPTEL etc.

Design for Additive Manufacturing
High Performance Computing
Applications of Computational Fluid Dynamics
Aerodynamics of Launcher And Reentry Vehicles
Fundamentals of Database Systems
Object Oriented Programming Development and Languages
Design of Algorithm

Competency Building Courses

·Aero sketching
·Aero modelling
·Reverse engineering (software used CATIA-DSE, QSR)
·3D printing and prototyping
·Aircraft structure design (software used CATIA)
·Structural Analysis (software used ANSYS)
·System integration
·Mechanism Design (CATIA DMU)
·Computational Fluid Analysis (CFD) (software used ANSYS FLUENT)
·Manufacturing Fundamentals
·Machining (software used Mastercam)
·Maintenance and Repair
·PLM (Product Lifecycle Management)

Career Development Courses

·CATIA
·CREO Parametric
·ANSYS
·Solid works
·NASTRAN & PATRAN
·HYPERMESH
·NX/Unigraphics
·CNC Programming
·Python Programming
·Matlab
·Aptitude and Reasoning
·Professional Communication & Soft Skills

The components of curriculum is divided as follows

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Basic Sciences	11.87	21	19
Basic Engineering	11.25	23	18
Humanities and Social Sciences	2.5	5	4
Program Core	41.87	79	67
Program Electives	11.25	18	18
Open Electives	5.62	09	09
Project(s)	8.75	28	14
Any other (Skill)	6.87	19	11
		Total number of c redits	160

COURSE **SYNOPSIS**

CORE **COURSES**

Mechanics of Solids

This course deals with the basic concepts of circuit analysis which is the foundation for all subjects of the electrical and electronics engineering. It includes the fundamental laws of electricity and magnetism with an emphasis on resistors, inductors, and capacitors (RLC) circuits applied to alternating current (AC) or direct current (DC) of electrical networks. Further this course provides network theorems with different excitations, two-port network, and network topology to solve for real-time applications.

Thermodynamics and Heat Transfer

This course is the field of physics which deals with the relationship between heat and mechanical work, and the properties of systems that bear relation to heat and work. General laws of energy transformations concerning all types of systems, mechanical, electrical and chemical may fall within the purview of this science.

Fluid Dynamics

This course will provide with the terminology associated with fluid mechanics and the use of fluid properties in solving problems. It also emphasizes on mathematical description of fluid flows. The basic conservation equations of a fluid flow are derived for different fluid flows. It introduces the concept of a boundary layer, boundary layer thickness and basic aspects of bluff body aerodynamics. Compare and contrast various fluid machinery based on flow properties and its applications.

Aircraft Structures

This course is designed to study the behaviour of aircraft structural elements subjected to inertial, aerodynamic, and maneuver loads. Thin walled beams, thin plates analysis are being conducted by energy methods. Structural idealization and load analysis on wing, fuselage, and landing gears are integral part of this course. The ultimate goal is to design and development of the new generation aircraft components. This course is a prerequisite for Analysis of Aircraft structures and Finite Element Methods/Analysis.

Aircraft Propulsion and Turbomachinery

An aerospace propulsion system is a machine that produces thrust to push an aircraft forward. This course introduces various aircraft propulsion systems, and their performance analysis. The course discusses the operating principles of the aircraft engine's major components such as inlets, compressors, turbines, and nozzles. The design parameters, performance characteristics, and the factors influencing them are also addressed. This course is a prerequisite to the next level course, Turbomachinery.

Aerodynamics

Aerodynamics course focuses on the study of the flow of air about a body, and the body can be an airplane, but many of the concepts explored are relevant to a wide variety of applications from sailboats, automobiles and birds. This course will enable learners to gain a fundamental understanding of concepts and models used to aerodynamically analyze and some classical theories which are useful for design of aircraft components.

Flight Mechanics

Flight mechanics is the science that investigates the performance of the aircraft as applied to flight vehicles and to provide a clear understanding of related topics, specifically on aerodynamics, propulsion, performance, stability and flight controls. The course introduces the fundamental principles of aerodynamics and propulsion for aircraft performance in classical flying stages.

Aerospace Materials and Production Technology

This course will provide good theoretical background and a sound practical knowledge of automation and computer integrated manufacturing to the engineering students. Hence production technology plays a vital role for design the components and producing it with minimum cost and with longer service.

Aerospace Propulsion

This course deals with the basic principles of rocket propulsion and presents an overview of the space missions followed by the system requirements. It includes an overview of different types of propulsion like solid, liquid and hybrid propulsion. Solid propulsion grain design and estimates for the mission will be evaluated by gaining knowledge.

Analysis of Aircraft Structures

The major emphasis of this course is to apply the concept of solid mechanics to aircraft structural components to determine deflections and stresses acting on components. Analysis and design of thin walled beams, thin plates analysis by using energy methods is dealt.

Gas Dynamics

This course is a branch of science deals with compressible flows in which density and temperature change are significant with variation in flow speed. The course is designed as a core course for the undergraduate students of Aerospace engineering and contains the basic material essential for a foundation of compressible flow aerodynamics. The course introduces the fundamental concepts and principles of compressible flow and intends to provide the necessary background for advanced studies on the subject.

Computational Aerodynamics and Turbulence Modelling

This course deals with the basic aspects of Computational Fluid Dynamics, emphasizing on the governing equations of fluid dynamics and their numerical discretization techniques using finite volume and finite difference methods. This course also describes the methods of grid generation techniques for both structured and unstructured grid in 2D as well as 3D. It describes the mathematical behaviour of the different classes of partial differential equations.

Finite Element Analysis

The finite element analysis (FEA) is a numerical method widely used for modeling and analyzing structures. This course introduces the mathematical modeling concepts of the Finite Element Method for solving structural, thermal and dynamics problems that are too complicated to be solved by analytical methods.

Flight Vehicle Design

This course is designed to provide students an understanding of procedure followed in conceptual design of an aircraft, meeting the user-specified design requirements and safety considerations specified by the aircraft certification agencies. The course introduces theoretical basics of methods and models that are used in the conceptual airplane design and discusses the theoretical problem-solving skills related to analysis and design of flight vehicle structures.

Aerospace Structural Dynamics

Aerospace Structural Dynamics subject focuses on the vibration analysis of different structural components. It provides the students with basic knowledge of mechanical vibrations of single and multiple degrees of freedom systems. These concepts are then extended to vibrations of continuum elastic bodies. Moreover, this course will also provide the required knowledge on aeroelasticity, which is one of the emerging fields of research in aerospace / aeronautical engineering.

PROFESSIONAL **ELECTIVES**

Heat and Mass Transfer

Heat transfer is the flow of thermal energy due to temperature difference and the subsequent temperature distribution changes commonly measured as heat flux. This course focuses on heat transfer modes such as conduction, convection and radiation, boundary conditions, one dimensional steady and unsteady state condition, heat exchangers and mass transfer mechanisms applied to modern aero-thermal systems for designing higher thermal efficient systems.

Mechanism and Machine Design

This is a basic course on modeling, design, integration and best practices for use of machine elements such as bearings, springs, gears, cams and mechanisms. Modeling and analysis of these elements is based upon extensive application of physics, mathematics and core mechanical engineering principles.

CAE/CAM

The goal of the course is to provide the students with an opportunity to conceive, design, and implement products quickly and effectively, using the latest rapid prototyping methods and CAD/CAE/CAM technology. Computer-AidedEngineering tools are the broad usage of computer software to aid in engineering analysis tasks.

AIRCRAFT SYSTEMS AND CONTROL

Aircraft systems and controls is required to introduce for operating an aircraft efficiently and safely, their complexity varies with the type of aircraft. This is involved with many subsystems which must meet demanding customer and operational lifecycle. This course comprises into simpler sub-systems such as electrical systems, hydraulic systems, pneumatic and engine control systems etc., that carry out homogeneous functions.

Space Dynamics

Space dynamics is a branch of physics that deals with the study of the system of forces acting on a celestial body motion under the influence of several celestial bodies.
The course emphasizes the theories and principles related to Orbital mechanics application of celestial mechanics to the practical problems concerning the motion of artificial spacecraft and rockets.

Aircraft Systems and Instrumentation

This course deals with concept and meaning of system and classifies the various systems required for aircraft and their contribution in order to fulfil the aircraft tasks. Describe the various types of Electrical power generations and distribution in aircraft. This course also helps student to get the knowledge of pneumatic, hydraulic and environmental control system, also Describes different actuators, flight control system and advanced flight actuation system.

Rocket and Missile Technology

This course deals with fundamental aspects of rockets and the current trends in rocket propulsion. It includes the combustion process, propellants and various components of chemical rocket propulsion systems and their applications. The course compares and contrasts various thrust vector control mechanisms of nozzle and cooling systems of combustion chamber.

Techniques in Wind Tunnel Testing

The experimental aerodynamics is the first course for graduate and undergraduate students in Aerospace Engineering. The testing methodology employed in low and high-speed aerodynamics is a new techniques through which the students will learn various types of wind tunnels, tools and techniques. A number of problems/examples will be cited to enhance the understanding of the subject matter and besides, many unsolved problems will be provided with answers to further test the student's learning.

Fatigue and Fracture of Materials

The major emphasis of this course is to apply the concept of solid mechanics to predict the failure and strength of a structure under fluctuating loads and under cracked conditions. Various theories related to fatigue were discussed. Mechanism and conditions of crack growth are included which is used for design of structure against crack growth.

Orbital Mechanics

Orbital mechanics or astrodynamics is the application of ballistics and celestial mechanics to the practical problems concerning the motion of rockets and other spacecraft.
The motion of these objects is usually calculated from Newton's laws of motion and law of universal gravitation.

Turbo Machinery

Turbo machinery describes machines that transfer energy between a rotor and a fluid like centrifugal pumps, including both turbines and compressors usually work with a gas.
Indulgent in application of aerospace jet engines, turbines and Centrifugal Compressors and Radial flow turbines relationships like Newton's second law of motion and Euler's pump and turbine equation for compressible fluids are also turbo machines

Theory of Stress Strain Measurements

Experimental stress analysis overs the primary components of experimental pressure evaluation that consists of exhaustive remedy of the maximum flexible strategies like photo elasticity and stress gauges and additionally a short advent to the rising strategies like virtual photograph correlation.

High Temperature Gas Dynamics

This course has been deigned to cover aerodynamic features of hypersonic flows with their basic governing equations and their applications in various flow fields. It also provides a comprehensive training experience in the basic principles, technologies and methodologies pertaining to the multi-disciplined realm of hypersonic flight.

Gas Turbines and Jet Propulsion Technology

The course will deal about the fundamentals of gas turbines, classifications, thermodynamic analysis, gas turbine parts, and performance of the components of the gas turbine.
It also incorporates efficiency and specific impulse for gas turbine. The course deals with testing engines for different parameters for optimized performance and safety.

Computational Fluid Dynamics

This course deals with the advanced aspects of Computational Fluid Dynamics, emphasizing on the governing equations of fluid dynamics and their numerical discretization techniques using panel methods, finite volume and finite difference methods. This course also describes the methods of grid generation techniques for both structured and unstructured grid with panel methods.

Unmanned Air Vehicles

The course focuses on fundamental s related to powered, aerial vehicle systems that do not carry a human operator, including t he terminology related to unmanned air vehicles (UAV), subsystems, basic design phases, a erodynamics, and also provides insight into different types of airframes and power-plants. It im parts knowledge about navigation, communications, control, and stability of UAVs. The co urse is aimed to obtain the knowledge also in commercial, private, public, and educational inte rest in UAS applications.

Air Transportation System

This course presents air transport system considers route structure options in terms of operational impacts and describes the context and boundaries of the industry – the natural, regulatory and operational environments 'Systems' perspectives are introduced to integrate the discussion of aircraft, airlines, airports and airspace issues.

Hypersonic Aerodynamics

Hypersonic aerodynamics is a special branch of the study of aeronautics. The chief characteristic of hypersonic aerodynamics is that the temperature of the flow around the aircraft is so great that the chemistry of the gas must be considered. At low hypersonic speeds, the molecular bonds vibrate, which changes the magnitude of the forces generated by the air on the aircraft.

Ground Vehicle Aerodynamics

Automotive aerodynamics is the study of the aerodynamics of road vehicles. Its main goals are reducing drag and wind noise, minimizing noise emission, and preventing undesired lift forces and other causes of aerodynamic instability at high speeds. Air is also considered a fluid in this case. For some classes of racing vehicles, it may also be important to produce down force to improve traction and thus cornering abilities.

Theory of Aeroelasticity

The major emphasis of this course is to apply the concept of solid mechanics, aerodynamics and theory of vibrations to predict the effect of aircraft vibrations. Lifting surface divergence and steady state aeroelastic problems are used to analyze the vibrations of control surfaces and wings. Applications of flutter in other fields are explored for real world problems like flutter of transmission lines.

Avionics and Instrumentation

Avionics deals with electronic systems which are used on aircraft, satellites and spacecraft's. This course covers the major phases of avionics from navigation, guidance, and communication to sophisticated system using state of art sensors and radars used in aerospace systems. Various electronic instrument systems, numbering systems, data buses, data conversion and logic gates are also covered.

Automatic Control of Aircraft

The system that is used to control the flight is called the flight control system (FCS). In the early days of flying, the FCS was mechanical. By means of cables and pulleys, the control surfaces of the aircraft were given the necessary deflections to control the aircraft. However, new technologies brought with it the fly-by-wire FCS. In this system electrical signals are sent to the control surfaces.

Helicopter Aerodynamics

This course provides a comprehensive study of the aerodynamics principles specific to helicopters. Students will explore the fundamental concepts underlying rotary-wing flight, including lift generation, rotor dynamics, and control mechanisms. The course aims to equip students with the theoretical knowledge and practical skills necessary to understand, analyze, and design helicopter systems.

Introduction to Nano Technology

Design and analysis of nano structures discusses about different requirements of composite structures will be discussed within the framework of the course and associated design concepts will be introduced. In particular, the requirements associated with production, assembly and loads occurring during operation will be considered.

Flight Scheduling and Operations

This course is designed to Explores a variety of models and optimization techniques for the solution of airline Schedule planning and operations problems. Schedule design, fleet assignment, aircraft maintenance routing, crew, Scheduling, passenger mix, and other topics are covered. Recent models and algorithms addressing issues of model. Integration, robustness, and operations recovery are introduced.

Non-Destructive Testing

Non-Destructive Testing (NDT) is the process of inspecting, testing, or evaluating materials, components or Assemblies for Discontinuities or differences in characteristics without destroying the serviceability of the part or system. This includes understanding the basic principles of various NDT methods, fundamentals, discontinuities in different product forms.

Engineering Optimization Techniques

The major emphasis of this course is to apply the concept of mathematical principles to obtain the required performance of systems. Various techniques in optimizations which include simplex methods and classical methods are discussed. Constrained and Un constrained techniques which are the part of engineering problems are addressed.

Molecular Gas Dynamics

The course is about microscopic approach to understanding the behaviour of a gas which states that all substances are composed of many very small particles (molecules or atoms). The observable properties of gas are the consequence of the actions of the molecules making up the gas.

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