INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**INTRODUCTION TO AEROSPACE ENGINEERING**				
Course Code	AAE001				
Programme	B.Tech				
Semester	III	AE			
Course Type	Foundation				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. R Sabari Vihar, Assistant professor				
Course Faculty	Ms. K. Sai Priyanka Assistant Professor				

I. COURSE OVERVIEW:

Introduction to Aerospace engineeringcovers the fundamental concepts, and approaches of aerospaceengineering, and are highlighted through lectures on aeronautics, astronautics, and design. Active learning aerospace modules make use of information technology. Student teams are immersed in a hands-on, lighter-than-air (LTA) vehicle design project, where they design, LTA vehicles. The connections between theory and practice are realized in the design exercises. The performance, weight, and principal characteristics of the LTA vehicles are estimated and illustrated using physics, mathematics, and chemistry known to freshmen, the emphasis being on the application of this knowledge to aerospace engineering and design rather than on exposure to new science and mathematics.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHS007	I	Applied Physics	4

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Introduction to aerospace engineering	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz / Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Assignments
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Assignments
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Videos

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	2	Tutorials
PSO2	**Problem-solving Skills:** Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.	--	---
PSO 3	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	--	---
PSO4	**Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aeronautical/aerospace allied systems to become technocrats.	1	Seminars

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Get the knowledge of technical areas of aerospace engineering including mechanics and physics of fluids, structures and materials, instrumentation, control and estimation, humans and automation, propulsion and energy conversion, aeronautical and astronautical systems
II	Understand the methodology and experience of analysis, modeling, and synthesis
III	Understand the evolution of human space exploration with a brief introduction to the missions conducted by various countries
IV	Knowledge in satellite engineering and the systems involved in the operation of satellites.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AAE001.01	CLO 1	Understand, Identify, Study and comprehend processes that lead to solutions to a particular problem.	PO1	2
AAE001.02	CLO 2	Develop one- self to gain knowledge about current technical term which helps to extend the outputs of research.	PO2	2
AAE001.03	CLO 3	Outline performance of the output of research, development, or design.	PO2	2
AAE001.04	CLO 4	Identify, solve new problems and gain new knowledge.	PO1	2
AAE001.05	CLO 5	Understand about the performance parameters, performance in steady flight, cruise, climb, range, endurance, accelerated flight symmetric maneuvers, turns, sideslips, takeoff and landing.	PO1	2
AAE001.06	CLO 6	Getting knowledge about the theory to produce a safe, effective, economic production of aircraft.	PO3	2
AAE001.07	CLO 7	Understand the theoretical knowledge behind the design and development of aircrafts.	PO1	2
AAE001.08	CLO 8	Gain knowledge about the basic Aerodynamics, Flight mechanics and aircraft structures which are the foundation stones for knowledge based exams.	PO1	2
AAE001.09	CLO 9	Discuss the principle constituents of the transportation system involved in civil and commercial aircrafts and understanding the working of space propulsion systems.	PO7	1
AAE001.10	CLO 10	Extend the outputs of earlier research and discover good ideas for new products or improving current products.	PO3	2
AAE001.11	CLO 11	Memorize procedure and steps to keep the products working effectively.	PO3	2
AAE001.12	CLO 12	Gain knowledge about the anatomy of aircraft, helicopters, satellites and other air vehicles, and about the working importance of each component in an air vehicle.	PO1	2
AAE001.13	CLO 13	Ability to summarize the efficiency of the design in achieving the mission goal and safety of flight.	PO3	2
AAE001.14	CLO 14	Understand the impact of radiations in the outer space on the spacecrafts and satellites and safety precautions to be followed.	PO7	1
AAE001.15	CLO 15	Choose a concept or idea of technical real time problems to form solutions for the same.	PO1	2

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO 1	2		2										2			1
CLO 2	2	3											2			
CLO 3		1											3			1
CLO 4																1
CLO 5	2		3													1
CLO 6	2		2										2			
CLO 7													2			
CLO 8	2		2										2			1
CLO 9	2															1
CLO 10			1										1			1
CLO 11																1
CLO 12																1
CLO 13	2															1
CLO 14			2										2			
CLO 15			2										2			1

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO 1, PO2,	SEE Exams	PO 1, PO 2, PO 3	Assignments	PO 1, PO 2	Seminars	PO 3
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	-						

XII. ASSESSMENT METHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

UNIT-I	HISTORY OF FLIGHT AND SPACE ENVIRONMENT
Balloons and dirigibles, heavier than air aircraft, commercial air transport; Introduction of jet aircraft, helicopters, missiles; Conquest of space, commercial use of space; Different types of flight vehicles, classifications exploring solar system and beyond, a permanent presence of humans in space; Earth's atmosphere, the standard atmosphere; The temperature extremes of space, laws of gravitation, low earth orbit, microgravity, benefits of microgravity; Environmental impact on spacecraft, space debris; Planetary environments	
UNIT-II	**INTRODUCTION TO AERODYNAMICS**
Anatomy of the airplane, helicopter; Understanding engineering models; Aerodynamic forces on a wing, force coefficients; Generating lift, moment coefficients; Aerodynamic forces on aircraft – classification of NACA airfoils, aspect ratio, wing loading, mach number, centre of pressure and aerodynamic centreaerofoil characteristics-lift, drag curves; Different types of drag..	
UNIT-III	**FLIGHT VEHIVLE PERFORMANCE AND STABILITY**
Performance parameters, performance in steady flight, cruise, climb, range, endurance, accelerated flight symmetric maneuvers, turns, sideslips, takeoff and landing. Flight vehicle Stability, static stability, dynamic stability; Longitudinal and lateral stability; Handling qualities of the airplanes	
UNIT-IV	**INTRODUCTION TO AIRPLANE STRUCTURES AND MATERIALS,POWER PLANT**
General types of construction, monocoque, semi-monocoque; Typical wing and fuselage structure; Metallic & non-metallic materials, use of aluminum alloy, titanium, stainless steel and composite materials; Basic ideas about engines, use of propeller and jets for thrust production; Principles of operation of rocket, types of rockets.	
UNIT-V	**SATELLITE SYSTEMS ENGINEERING HUMAN SPACE EXPLORATION**
Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems; Satellite structures, mechanisms and materials; Power systems; Communication and telemetry; Propulsion and station keeping; Space missions, mission objectives. Goals of human space flight missions, historical background, the Soviet and US missions; The mercury, Gemini, Apollo (manned flight to the moon), Skylab, apollo-soyuz, space Shuttle; International space station, extravehicular activity; The space suit; The US and Russian designs; Life support systems, flight safety; Indian effort in aviation, missile and space technology.	
Text Books:	
1. Newman D, "Interactive Aerospace Engineering and Design", McGraw-Hill, 1st Edition, 2002. 2. Anderson J. D, "Introduction To Flight", McGraw-Hill Education, 5th Edition,2002	
Reference Books:	
1. Kermode. A. C, "Flight without Formulae", McGraw Hill, 4th Edition, 1997. 2. Barnard R.H and Philpot. D.R, "Aircraft Flight", Pearson, 3rd Edition, 2004. 3. SwattonP.J, "Flight Planning", Blackwell Publisher, 6th Edition, 2002.	

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Balloons and dirigibles, heavier than air aircraft, commercial air transport.	CL01	T3 - 1.1
2	Introduction of jet aircraft, helicopters, missiles.	CL01	T3 - 1.2
3	Conquest of space, commercial use of pace, exploring solar system and beyond, a permanent presence of humans in space.	CL02	T3- 1.3
4	Earth's atmosphere, standard atmosphere, temperature extremes of space.	CL02	T1-1.6
5	Laws of gravitation, low earth orbit, microgravity, benefits of microgravity.	CL03	T1-1.8.1
6	The near earth radioactive environment. The magnetosphere. Environmental impact on spacecraft.	CL02	T1-1.8.2

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
7	Meteoroids and micrometeoroids, space debris. Planetary environments.	CL02	T1-1.8.4
8	Anatomy of the airplane, helicopter, launch vehiclesand missiles, space vehicles.	CL012	T3-1.9
9-10	Static forces and moments on the vehicle.	CL07	T2-2.1
11	Understanding engineering models aerodynamic forces on a wing, force coefficients. Generating lift.	CL010	T3-2.2
12	Moment coefficients, center of pressure, aerodynamic of wings. Sources of drag.	CL08	T2-2.4
13-14	Thrust for flight, the propeller and the jet engine, governing equations, rocket engines.	CL07	T2-3.1
15-16	Performance parameters, performance in steady flight.	CL05	T2-3.5
17-19	Cruise, climb, range, endurance, accelerated flight symmetricmaneuvers, turns, sideslips, takeoff and landing.	CL05	T2-3.7.1
20-22	Flight vehicle Stability, static stability, dynamic stability. Longitudinal and lateral stability, handling qualities of theairplanes.	CL08	T2-3.73
23-24	General types of construction, monocoque, semi-monocoque.	CL08	T1-3.8
25	Typical wing and fuselage structure.	CL08	T1-3.8.4
26	Metallic & non-metallic materials.	CL010	T1-3.8.5
27-28	Use of aluminum alloy, titanium, stainless steel.	CL010	T1-4.2
29-30	Use of composite materials.	CL010	T1-4.4
31-32	Basic ideas about engines, use of propeller and jets for thrust production.	CL011	T1-4.5
33	Principles of operation of rocket, types of rockets.	CL09	T1-4.6
34-35	Satellite missions, an operational satellite system, elements of satellite, satellite bus subsystems.	CL013	T1-4.7.1
36	Satellite structures, mechanisms and materials.	CL014	T1-4.9
37-39	Propulsion and station keeping. Space missions. Mission objectives. Case studies.	CL011	T1-5.1.1
40-41	Communication and telemetry. Thermal control. Attitude determination and control.	CL015	T1-5.2
42	Goals of human space flight missions. Historical background. The Soviet and US missions.	CL02	T1-5.3
43-44	The Mercury, Gemini, Apollo (manned flight to the moon), Skylab, Apollo-Soyuz, Space Shuttle. International Space Station, extravehicular activity.	CL02	T1-5.6
45	The space suit. The US and Russian designs. Life support systems. Flight safety.	CL02	T1-5.7

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Gain information about lift augmentation devices and control surfaces	Seminars / Guest Lectures / NPTEL	PO 1, PO 3	PSO 4

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