



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	AIR TRANSPORTATION SYSTEM				
Course Code	AAE 526				
Programme	B. Tech				
Semester	VI	AERO			
Course Type	Accelerated				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Chief Coordinator	Mr. P Anudeep, Assistant Professor				
Course Faculty	Mr. P Anudeep, Assistant Professor				

I. COURSE OVERVIEW:

A system of air transportation in which local airports offer air transportation to a central airport where long distance flights are available called air transportation system. This course provides an overview of the air transportation system that illustrates the interdependence among its components i.e. airlines, airports, civil aviation authorities and air navigation services. This will include understanding the role, function and operation of aircraft, in addition to airports, airspace and commercial airlines

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AAE001	III	Introduction to Aerospace Engineering	3

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Air Transportation System	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
	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 to 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
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Presentation on real-world problems
PO2	Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Seminars
PO3	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.	1	Assignments
PO7	Environment and sustainability: Understand the impact of the professional engineering solution sin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2	seminars

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	1	Lectures, Assignments, Seminars
PSO 2	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	-	-
PSO 4	Successful career and entrepreneurship: To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Apply knowledge and skills in the aviation industry and make more effective decisions for organisation.
II	Provide insight into current trends and issues in civil aviation, such as aviation safety and security, law and new technology.
III	Understand complexity of air transport operation and to find best solution for the issues.
IV	Understand many transport issues involved in handling passengers, freight of aircraft.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Explain the roles of the International Civil Aviation Organization and the International Air Transport Association in fostering safe and efficient air transport	CLO 1	Communicate at technical level with aviation service providers and aerospace professionals and organizations about aircraft and their systems.
		CLO 2	Describe the effects the atmosphere has on aircraft operations and the implications for the air transport industry.
		CLO 3	Analyze the aerodynamic and associated performance characteristics for aircraft and infer the corresponding economic implications.
CO 2	Describes national and international rules and regulations for air transportation	CLO 4	Assess the impact of contemporary challenges and practical aspects in air transportation.
		CLO 5	Evaluate pros and cons of emerging technological aspect and responses.
		CLO 6	Develop an applied knowledge to the global aviation industry and key issues.
CO 3	Identify organizations controlling the regulatory processes in international aviation	CLO 7	Understand international law and policies related to air transportation activities.
		CLO 8	Assess the impact of airline activities and operations on economics and finances.
		CLO 9	Evaluate the various factors influencing aviation industry and effects of these factors on air transportation
CO 4	Apply basic science principles in estimating stopping and passing sight distance requirements	CLO 10	Developing capability to asses' functions of airports, the basic principles of aviation policy.
		CLO 11	Execution of aviation policies related to airline economics and flight planning.
		CLO 12	Implementing standard procedure for air cargo handling and its management.
CO 5	Understand the factors influencing road vehicle performance characteristics and design	CLO 13	Exposit legal, social, economic, ethical and environment interest while undertaking air transportation system.
		CLO 14	Acquire the competencies to handle airspace, aircrafts and air traffic control system.
		CLO 15	Develop knowledge to coordinate with different organization in the air transportation system.

X. 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
AAE526.01	CLO 1	Communicate at technical level with aviation service providers and aerospace professionals and organizations about aircraft and their systems.	PO 2	2
AAE526.02	CLO 2	Describe the effects the atmosphere has on aircraft operations and the implications for the air transport industry.	PO 2	3
AAE526.03	CLO 3	Analyze the aerodynamic and associated performance characteristics for aircraft and infer the corresponding economic implications.	PO 2 PO 3	3
AAE526.04	CLO 4	Assess the impact of contemporary challenges and practical aspects in air transportation.	PO 2	2
AAE526.05	CLO 5	Evaluate pros and cons of emerging technological aspect and responses.	PO 1	2

AAE526.06	CLO 6	Develop an applied knowledge to the global aviation industry and key issues.	PO 1	2
AAE526.07	CLO 7	Understand international law and policies related to air transportation activities.	PO 1	1
AAE526.08	CLO 8	Assess the impact of airline activities and operations on economics and finances.	PO 1	1
AAE526.09	CLO 9	Evaluate the various factors influencing aviation industry and effects of these factors on air transportation	PO 2	2
AAE526.10	CLO 10	Developing capability to asses' functions of airports, the basic principles of aviation policy.	PO 2 PO 3	2
AAE526.11	CLO 11	Execution of aviation policies related to airline economics and flight planning.	PO 1	3
AAE526.12	CLO 12	Implementing standard procedure for air cargo handling and its management.	PO 1	3
AAE526.13	CLO 13	Exposit legal, social, economic, ethical and environment interest while undertaking air transportation system.	PO 7	2
AAE526.14	CLO 14	Acquire the competencies to handle airspace, aircrafts and air traffic control system.	PO 1 PO 2	2
AAE526.15	CLO 15	Develop knowledge to coordinate with different organization in the air transportation system.	PO 1	2

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XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			Program Specific Outcomes (PSOs)
	PO 1	PO 2	PO 5	PSO 2
CO 1	3	2	1	2
CO 2	3	2	1	2
CO 3	3	2	1	
CO 4	3	2	1	
CO 5	3	2	1	2

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XII. 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														
CLO 2		2														
CLO 3		3	1										1			

CLO 4		3																
CLO 5	2																	
CLO 6	2																	
CLO 7	2																	
CLO 8	2																	
CLO 9		3																
CLO 10		2	1											1				
CLO 11	2																	
CLO 12	2																	
CLO 13							2											
CLO 14	3	2																
CLO 15	2																	

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XIII. ASSESSMENT METHODOLOGIES-DIRECT

CIE Exams	PO 1, PO 2, PO 3, PO 7, PSO 1	SEE Exams	PO 1, PO 2, PO 3, PO 7, PSO 1	Assignments	PO 3	Seminars	PO 2, PO7
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO 2						

XIV. ASSESSMENT METHODOLOGIES-INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV. SYLLABUS

UNIT-I	AVIATION INDUSTRY
Introduction, history of aviation, evolution, development, growth, challenges; Aerospace industry, air transportation industry- economic impact, types and causes; Airline industry, structure and economic characteristics; Airlines as oligopolists, other unique economic characteristics; Significance of airline passenger load factors.	
UNIT-II	NATURAL ENVIRONMENT, REGULATORY ENVIRONMENT AND OPERATIONAL ENVIRONMENT
The earth as a habitat, The Earth: physical issues affecting demand- surface, core, continents; Shape of demand; Demand forecasting- based on historical data, comparative analysis, theoretical demand models; Reliability of forecasts; The breadth of regulation- ICAO, IATA, national authorities (DGCA, FAA); Service properties: service volumes, international air service agreements, deregulation, privatization; Evolution: Communication, navigation and surveillance systems (CNSS); Radio communications: VHF,	

HF, ACARS, SSR, ADS; Navigation: NDB, VOR, DME, area-navigation systems(R-Nav), ILS, MLS, GPS, INS, laser-INS; Surveillance: SSR, ADS; Airborne elements: AFCS, PMS, electronic control and monitoring/engine instrumentation and central automated systems, EFIS, FMS, GPWS, TCAS- future trends.	
UNIT-III	AIRCRAFT
Costs- project cash-flow, aircraft price; Compatibility with the operational infrastructure; Direct and indirect operating costs; Balancing efficiency and effectiveness-payload-range, fuel efficiency. Technical contribution to performance, operating speed and altitude, aircraft field length performance; Typical operating costs; Effectiveness- wake-vortices, cabin dimensions, flight deck.	
UNIT-IV	AIRPORTS AND AIRLINES
Setting up an airport: airport demand, airport siting, runway characteristics, length, declared distances, aerodrome areas, obstacle safeguarding; Runway capacity, evaluating runway capacity, sustainable runway capacity; Setting up an airline, modern airline objectives; Route selection and development, airline fleet planning, annual utilization and aircraft size, seating arrangements; Indirect operating costs; Aircraft- buy or lease; Revenue generation, computerized reservation systems, yield management; Integrating service quality into the revenue-generation process; Marketing the seats; Airline scheduling; Evaluating success, financial viability, regulatory compliance, efficient use of resources, effective service	
UNIT-V	AIRSPACE
Categories of airspace, separation minima, airspace sectors, capacity, demand and delay; Evolution of air traffic control system, procedural ATC system, procedural ATC with radar assistance, first generation 'automated system, current generation radar and computer-based ATC systems; Aerodrome air traffic control equipment and operation - ICAO future air-navigation systems (FANS); Air-navigation service providers as businesses	
Text Books:	
1. Hirst, M., The Air Transport System, Woodhead Publishing Ltd, Cambridge, England, 2008.	
Reference Books:	
1. Wensven, J.G., Air Transportation: A Management Perspective, Ashgate, 2nd Edition 2007. 2. Belobaba, P. Odoni, A. and Barnhart, C., Global Airline Industry, 2nd Edition Wiley, 2009. 3. M. Bazargan, M., Airline Operations and Scheduling, Ashgate, 1st Edition 2004.	

XVI. 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
1-2	Introduction, history of aviation.	CLO 1	R1:1.1
3-4	Evolution, development, growth, challenges.	CLO 2	R1:1.1
5-7	Aerospace industry, air transportation industry.	CLO 1	R1:1.2,1.3
8-9	Economic impact, types and causes; Airline industry.	CLO 3	R2:1.1
10	Structure and economic characteristics; Airlines as oligopolists.	CLO 3	R1:6.2
11-14	Other unique economic characteristics; Significance of airline passenger load factors.	CLO 3	R1:6.3,6.4
15-17	The earth as a habitat, The Earth: physical issues affecting demand	CLO 8	T1:2.2,2.3
18-19	Surface, core, continents; Shape of demand; Demand forecasting-based on historical data, comparative analysis.	CLO 9	T1:2.4,2.5

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
20-21	Theoretical demand models; Reliability of forecasts; The breadth of regulation- ICAO, IATA, national authorities (DGCA, FAA).	CLO 7	T1:2.5.3,2.6,3.2
22-23	Service properties: service volumes, international air service agreements, deregulation, privatization; trends	CLO 13	T1:3.4,3.4.2,3.4.3,3.4.4
24	Evolution: Communication, navigation and surveillance systems (CNSS)	CLO 14	T1:4.2,4.3,4.3.2,4.3.3
25	Radio communications: VHF, HF, ACARS, SSR, ADS; Navigation: NDB, VOR, DME,	CLO 14	T1:4.3.1,4.3.2
26-28	Area-navigation systems (R-Nav), ILS, MLS, GPS, INS, laser-INS; Surveillance: SSR, ADS; Airborne elements: AFCS, PMS, electronic control and monitoring/engine instrumentation and central automated systems, EFIS, FMS, GPWS, TCAS- future trends.	CLO 14	T1:4.3.2,4.4.1
29	Costs- project cash-flow, aircraft price.	CLO 3	T1:5.2
30-31	Compatibility with the operational infrastructure; Direct and indirect operating costs	CLO 2	T1:5.3,5.4
32	Balancing efficiency and effectiveness-payload-range, fuel efficiency.	CLO 5	T1:5.5
33-34	Technical contribution to performance, operating speed and altitude, aircraft field length performance.	CLO 1	T1:5.5.3
35	Typical operating costs; Effectiveness- wake vortices, cabin dimensions, flight deck.	CLO 3	T1:5.5.4,5.6,5.6.2
36-37	Setting up an airport: airport demand, airport siting, runway characteristics, length, declared distances	CLO 6	T1:7.2,7.3,7.4,7.5
38-40	Aerodrome areas, obstacle safeguarding; Runway capacity, evaluating runway capacity, sustainable runway capacity.	CLO 15	T1:7.5.3,7.6,7.6.2 R1:11.6
41	Setting up an airline, modern airline objectives; Route selection and development.	CLO 15	T1:6.2,6.3,6.4 R2:6.2
42	Airline fleet planning, annual utilization and aircraft size, seating arrangements; Indirect operating costs.	CLO 12	T1:6.5,6.6,6.7,6.8
43	Aircraft- buy or lease; Revenue generation, computerized reservation systems, yield management; Integrating service quality into the revenue-generation process; Marketing the seats.	CLO 8	T1:6.11,6.12,6.13,6.14
44	Airline scheduling; Evaluating success, financial viability, regulatory compliance.	CLO 6	T1:6.15,6.16,6.16.2
45	Efficient use of resources, effective service.	CLO 4	T1:6.16.4

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

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Application of knowledge and skills in the estimation of Air Transportation System.	Seminars / Expert Lectures / Flight testing	PO 2, PO 4	PSO 1
2	On job training on air traffic control, airspace, aircraft operation is needed	Practical exposure is needed.	PO 2, PO 4	PSO 1

Prepared by:
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HOD, AE