INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**FLIGHT SCHEDULING AND OPERATIONS**			
Course Code	**A72121**			
Class	**IV B. Tech I Semester-R15**			
Regulation	**R15-JNTUH**			
Course Structure	**Lectures**	**Tutorials**	**Practical's**	**Credits**
	4	-	-	4
Course Coordinator	Ms. M Snigdha, Assistant Professor, Department of Aeronautical Engineering			
Team of Instructors	Ms. M Snigdha, Assistant Professor, Department of Aeronautical Engineering			

I. COURSE OVERVIEW

The aim is to introduce students the availability of various alternate sources of renewable energy for different day to day applications. The course covers basic principles of each of the source and the related details of equipment for given use. After completion of the course the student gains adequate knowledge to compare different sources of energy for selection and applying economically.

II. PREREQUISITE(S)

Level	Credits	Periods	Prerequisite
UG	4	4	Airport Planning And Operations

III. MARKS DISTRIBUTION

Sessional Marks	University End Exam Marks	Total Marks
Mid Semester Test There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 10 marks of 60 minutes duration. Subjective test of shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks of 20 minutes duration. It consists of 10 Multiple choice and 10 objective type questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. **Assignment** Five marks are marked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.	75	100

IV. EVALUATION SCHEME

S No	Component	Duration	Marks
1	I Mid examination	80 minutes	20
2	I Assignment	--	05
3	II Mid examination	80 minutes	20
4	II Assignment	--	05
5	External examination	3 hours	75

V. COURSE OBJECTIVES:

The objective of the teacher is to impart knowledge and abilities to the students to:

I. Discuss airline network flows for minimum and maximum cost flow problem.
II. Understand mathematical formulation-decision variables, objective function, constraints and methods of solution for airline scheduling.
III. Understand the importance fleet assignment and crew and manpower scheduling.
IV. Demonstrate assignment and aircraft boarding strategy.
V. Understand the common strategies for aircraft boarding.

VI. COURSE OUTCOMES

At the end of the course the students are able to:

1. Describe the complexity of airline planning, operations and dispatch.
2. Calculate the shortest path flow for minimum cost flow problem.
3. Understand the maximum path flow for multi commodity flow problem.
4. Analyse the Integer programming models- set covering/ partitioning problems, traveling salesman problem
5. Differentiate and analyze the problems in aircraft routing and management for maintenance of regular operations.
6. Differentiate and analyze the problems in aircraft routing and management of irregular operations.
7. Analyze the role of solution for constructing flight scheduling and operations.
8. Evaluate and explain with the block diagram for the time band approximation model
9. Analyze the route development and construction phases for flight scheduling process.
10. Apply the formulation of crew pairing problem, crew rostering, and crew generators.
11. Analyze the gate assignment for different terminal gates and aircraft boarding strategy.
12. Discuss fleet assignment pairing for different airlines and crew and manpower scheduling.
13. Explain the scheduling construction for economic viability and operations feasibility.
14. Explain the levels of handling the passenger flow and distance matrix.
15. Calculate the mathematical modeling for the interferences and model description for aisle interferences.

VII. HOW PROGRAM OUTCOMES AREASSESSED

Program outcomes		Level	Proficiency assessed by
PO1	**General knowledge:** An ability to apply the knowledge of mathematics, science and Engineering for solving multifaceted issues of Aeronautical Engineering.	S	Assignments
PO2	**Problem Analysis**: An ability to communicate effectively and to prepare formal technical plans leading to solutions and detailed reports for Aeronautical systems.	H	Exercise
PO3	**Design/Development of solutions**: To develop Broad theoretical knowledge in Aeronautical Engineering and learn the methods of applying them to identify, formulate and solve practical problems involving Aerodynamics.	S	Assignments, Discussion
PO4	**Conduct investigations of complex problems**: An ability to apply the techniques of using appropriate technologies to investigate, analyze, design, simulate and/or fabricate/commission complete systems involving complex aerodynamics flow situations.	S	Exercise
PO5	**Modern tool usage**: An ability to model real life problems using different hardware and software platforms, both offline and real-time with the help of various tools along with upgraded versions.	-	-
PO6	**The engineer and society**: An Ability to design and fabricate modules, control systems and relevant processes to meet desired performance needs, within realistic constraints for social needs.	-	-
PO7	**Environment and sustainability**: An ability To estimate the feasibility, applicability, optimality and future scope of power networks and apparatus for design of eco-friendly with sustainability	-	-
PO8	**Ethics**: To Possess an appreciation of professional, societal, environmental and ethical issues and proper use of renewable resources	-	-
PO9	**Individual and team work**: An Ability to design schemes involving signal sensing and processing leading to decision making for real time Aeronautical systems and processes at individual and team levels.	-	-
PO10	**Communication**: an Ability to work in a team and comprehend his/her scope of work, deliverables, issues and be able to communicate both in verbal, written for effective technical presentation	-	-
PO11	**Project management and finance**: To be familiar with project management problems and basic financial principles for a multi-disciplinary work.	-	-
PO12	**Life-long learning**: An ability to align with and upgrade to higher learning and research activities along with engaging in life-long learning.	S	Prototype, Discussions

S – Supportive **H – Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products.	H	Lectures, Assignments
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.	S	Tutorials
PSO3	**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.	S	Seminars and Projects
PSO4	**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.	-	-

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IX. SYLLABUS

UNIT-I:

NETWORK FLOWS AND INTEGER PROGRAMMING MODELS

Complexity of airline planning, operations and dispatch- need for optimization- role of operations research and simulation. Networks- definitions, network flow models- shortest path problem, minimum cost flow problem, maximum flow problem, multi-commodity problem. Integer programming models- set covering/ partitioning problems, traveling salesman problem- mathematical formulation- decision variables, objective function, constraints, and methods of solution, Solution by simulation.

UNIT-II:

AIRCRAFT ROUTING AND MANAGEMENT OF IRREGULAR OPERATIONS

Goal of aircraft routing- maintenance requirements, other constraints. Routing cycles, route generators. Mathematical models of routing- decision variables, objective functions, alternatives, constraints- flight coverage and aircraft available. Example problems and solutions. The problem statement, the time band approximation model-formulation of the problem-the scenarios- solution.

UNIT-III:

FLIGHT SCHEDULING

Significance of flight scheduling. The route system of the airlines- point-to-point flights, hub and spoke flights.

Schedule construction-operational feasibility, economic viability. Route development and flight scheduling process- load factor and frequency- case study.

UNIT-IV:

FLEET ASSIGNMENT AND CREW AND MANPOWER SCHEDULING

Purpose of fleet assignment. Fleet types, fleet diversity, and fleet availability-performance measures, Formulation of the fleet assignment problem- decision variables, objective function, constraints, and solution. Scenario analysis, fleet assignment models. Crew scheduling process-significance. Development of crew pairing- pairing generators- mathematical formulation of crew pairing problem-methods of solution. Crew rostering- rostering practices. The crew rostering problem-formulation, solutions. Man power scheduling- modeling, formulation of the problem, solutions.

UNIT-V:

GATE ASSIGNMENT AND AIRCRAFT BOARDING STRATEGY

Gate assignment-significance- the problem-levels of handling-passenger flow, distance matrix-mathematical formulation, solution. Common strategies for aircraft boarding process, mathematical model, interferences, model description, aisle interferences.

TEXT BOOKS:

1. Bazargan M,"Airline Operations and Scheduling", 2nd edn, Ash gate Publishing Ltd, 2010.

REFERENCES:

1. Belobaba P, Odoni, A., Barnhart, C. „The Global Airline Industry", Wiley, 2009.
2. Wu, Cheng-Lung, „Airline Operations and Delay Management", Ashgate Publishing Ltd, 2010.
3. Wensveen, J.G., „Air Transportation: A Management Perspective", 6th edn, Ashgate Publishing Ltd, 2007.
4. Ahuja, R. et al, „Network Flows-Theory, Algorithms and Applications", Prentice-Hall, 1993.
5. Yu. G, "Operations Research in Airlines Industry", Academic Publishers, 1998.
6. www.airlinestechnology.net

X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No	Course Learning Outcomes	Topics to be covered	Reference
1-4	Define different types of Programming Models	**UNIT I: NETWORK FLOWS AND INTEGER PROGRAMMING MODELS:** Complexity of airline planning, operations and dispatch-need for optimization-role of operations research and simulation	T1-1.1,1.2,1.3
5-10	Classification of network flow models	Networks-definitions, network flow models- shortest path problem, minimum cost flow problem, maximum flow problem, multi-commodity problem	T1-1.4,1.5,1.6
10-13	Describe integer programming models	Integer programming models-set covering/partitioning problems, traveling salesman problem-mathematical formulation-decision variables, objective function, constraints, and methods of solution. Solution by simulation.	T1-1.7,1.8,1.9,1.10
14-20	Define Routing Cycles, Routing Generators	**UNIT II: AIRCRAFT ROUTING**: Goal of aircraft routing-maintenance requirements, other constraints. Routing cycles, route generators.	T1-2.1,2.2,2.3,2.4
20-24	Define flight coverage and aircraft availability	Mathematical models of routing-decision variables, objective functions, alternatives, and constraints-flight coverage and aircraft available, Example problems and solutions	T1-2.5,2.5.1,2.5.2,2.5.3,
25-28	Explain the operations of airline irregular schedule and recovery	The problem statement, the time band approximation model, formulation of the problem-the scenarios-solution.	T1-2.6,2.7
29-34	Define The Term flight scheduling and the route system of the airlines	**UNIT III : FLIGHT SCHEDULING**: Significance off light scheduling. The route system of the airlines-point-to-point flights, hub and spoke flights	T1-3.1,3.2,3.3
34-39	Explain schedule construction	Schedule construction-operational feasibility, economic viability	T1-3.4
39-42	Discuss route development and flight scheduling process	Route development and flight scheduling process- load factor and frequency-case study.	T1-3.5,3.6
42-45	Explain the purpose of fleet assignment and classification of fleet types, fleet diversity	**UNIT IV`: FLEET ASSIGNMENT AND CREW AND MANPOWER SCHEDULING: Purpose** of fleet assignment. Fleet types, fleet diversity, fleet availability-performance measures, Formulation of the fleet assignment problem	T1-4.1,4.2,4.3
46-48	Explain fleet availability	Decision variables, objective function, constraints, solution. Scenario analysis, fleet assignment models	T1-4.4,4.5,4.6
49-53	Explain the process of crew scheduling	Crew scheduling process- significance. Development of crew pairing- pairing generators- Mathematical formulation of crew pairing problem- methods of solution.Crew rostering-rostering practices..	T1-5.1,5.2,5.3
54-59	Define crew rostering problem and formulation of solutions	The crew rostering problem-formulation, solutions. Man power scheduling-modeling, formulation of the problem, solutions.	T1-5.4,5.5
60-67	Describe the different levels of gate assignment	**UNIT V: GATE ASSIGNMENT AND AIRCRAFT BOARDING STRATEGY:** Gate assignment-significance-the problem-levels of handling-passenger flow, distance matrix-mathematical formulation, solution	T1-5.6,5.6.1,5.6.2
68-72	Explain the common boarding process of an aircraft	Common strategies for aircraft boarding process, mathematical model, interferences, model, description, aisle interference.	T1-5.7,5.7.1,5.7.2

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Objectives	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
I	S	H	S		S							H	H			
II														S		
III														H		
IV	H				S							H		H		
V	S	H	S	S	S							H	H			

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XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Outcomes	Program Outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	H			S									H			
2			S											H		
3					H										H	
4		H											H			
5			H	H											S	
6		H		H												
7	H															
8	H										H					
9		H	H											H		
10	H		H								H		H		S	
11		H									S		H			
12	H		H												H	
13		H									S		H		H	
14	H	S									H					
15	H		H										H		S	

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Prepared by: Ms. M Snigdha, Assistant Professor

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