Hall Ticket No | | | | | | | | | | | Question Paper Code: BAEB05

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - II

M.TechI Semester End Examinations, January- 2020

Regulations: R18

ADVANCED COMPUTATIONAL AERODYNAMICS

(AEROSPACE ENGINEERING)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT– I

1.	a)	Differentiate between Steger-Warming flux vector splitting method and Van Leer flux vector splitting method	**[7M]**
	b)	List the difference between flux approach and vector splitting methods.	**[7M]**
2.	a)	Discuss the basic principle of upwind schemes and the numerical solution	**[7M]**
	b)	What is the need of upwind reconstruction? Explain the concept of upwind reconstruction in brief.	**[7M]**

UNIT – II

3.	a)	Explain in brief the necessity and requirement of time split methods for numerical solutions.	**[7M]**
	b)	Discuss approximate factorization schemes for time dependent methods.	**[7M]**
4.	a)	Briefly explain the McCormack two step Predictor-corrector method with the neat sketch.	**[7M]**
	b)	Discuss the forward-time forward space method, forward-time central space method and forward-time backward space method.	**[7M]**

UNIT – III

5.	a)	Differentiate the explicit and implicit discretization in detail with the help of neat sketch.	**[7M]**
	b)	Define domain of dependence and range of influence Discuss the boundary conditions at interface between grid blocks.	**[7M]**
6.	a)	Define the concept of periodic boundaries. Explain in brief about the concept of dummy cell.	**[7M]**
	b)	Explain the Keller- box scheme. List out the modifications for lifting bodies to be done in farfield.	**[7M]**

UNIT – IV

7. a) Explain in brief about the importance of finite element method and its comparison with method of characteristics. **[7M]**
   b) Define initial data line in method of characteristics. Summarize the philosophy of method of characteristics **[7M]**

8. a) Explain minimum length nozzles with the help of neat sketch and its application. **[7M]**
   b) Discuss the concept of characteristic variable in farfield for the method of characteristics. **[7M]**

UNIT – V

9. a) Describe the effect of compressibility and viscosity that to be accounted for thin airfoil theory. **[7M]**
   b) Derive the velocity components at different cases for two dimensional constant strength source distributions. **[7M]**

10. a) Differentiate between the Neumann boundary condition and Drichlet boundary condition. **[7M]**
    b) Briefly explain about the secondary computation or about aerodynamics loads and how are they calculated? **[7M]**

COURSE OBJECTIVES:

The course should enable the students to:

I	Explain the concept of panel methods, analyze various boundary conditions applied and demonstrate several searching and sorting algorithms.
II	Describe the initial methods applied in the process of CFD tools development their advantages and disadvantages over modern developed methods.
III	Demonstrate different methods evolved in analyzing numerical stability of solutions and evaluate the parameters over which the stability depends and their range of values.
IV	Understand advanced techniques and methods in time marching steps and identify different boundary conditions for different cases in CFD techniques.

COURSE OUTCOMES (COs):

CO 1	Understand the solution methodology and numerical solutions for the boundary layer.
CO 2	Summarize various types of equations, their solution techniques including their stability.
CO 3	Demonstrate to write and solve implicit and explicit equations including stability of the solution.
CO 4	Illustrate the concepts of method of characteristics and its applications in nozzle designs.
CO 5	Describe basic formulation techniques and boundary condition for panel methods.

COURSE LEARNING OUTCOMES (CLOs):

BAEB05.01	Understand the concept of flux approach and its formulations.
BAEB05.02	Explain the Euler equations for the aerodynamic solutions computationally.
BAEB05.03	Emphasize on basic schemes to solve the differential equations.
BAEB05.04	Understand the stability of the solution by time dependent methods.
BAEB05.05	Explain the implicit methods for the time dependent methods to solve computationally.
BAEB05.06	Develop the approximate factorization schemes for time dependent methods.
BAEB05.07	Illustrate to apply concepts of discretization and its application for implicit difference equation.
BAEB05.08	Distinguish implicit and explicit discretization and differentiation equations for the stability of solution.
BAEB05.09	Explain the flow gradients at boundaries of unstructured grids.
BAEB05.10	Understand the concept of philosophy of method of characteristics
BAEB05.11	Explain supersonic nozzle design using method of characteristics.
BAEB05.12	Differentiate the domain of dependence and range of influence.
BAEB05.13	Understand the basic formulation and boundary conditions.
BAEB05.14	Explain the reduction of a problem to a set of linear algebraic equations.
BAEB05.15	Discuss the preliminary considerations prior to establishing numerical solution.

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES:

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	BAEB05.02	Explain the Euler equations for the aerodynamic solutions computationally.	CO 1	Remember
	b	BAEB05.01	Understand the concept of flux approach and its formulations.	CO 1	Understand
2	a	BAEB05.02	Explain the Euler equations for the aerodynamic solutions computationally.	CO 1	Understand
	b	BAEB05.02	Explain the Euler equations for the aerodynamic solutions computationally.	CO 1	Remember
3	a	BAEB05.05	Explain the implicit methods for the time dependent methods to solve computationally.	CO 2	Remember
	b	BAEB05.04	Understand the stability of the solution by time dependent methods.	CO 2	Remember
4	a	BAEB05.04	Understand the stability of the solution by time dependent methods.	CO 2	Remember
	b	BAEB05.04	Understand the stability of the solution by time dependent methods.	CO 2	Remember
5	a	BAEB05.08	Distinguish implicit and explicit discretization and differentiation equations for the stability of solution.	CO 3	Remember
	b	BAEB05.08	Distinguish implicit and explicit discretization and differentiation equations for the stability of solution.	CO 3	Remember
6	a	BAEB05.09	Explain the flow gradients at boundaries of unstructured grids.	CO 3	Understand
	b	BAEB05.07	Illustrate to apply concepts of discretization and its application for implicit difference equation.	CO 3	Understand
7	a	BAEB05.12	Differentiate the domain of dependence and range of influence.	CO 4	Remember
	b	BAEB05.11	Explain supersonic nozzle design using method of characteristics.	CO 4	Understand
8	a	BAEB05.11	Explain supersonic nozzle design using method of characteristics.	CO 4	Understand
	b	BAEB05.11	Explain supersonic nozzle design using method of characteristics.	CO 4	Remember
9	a	BAEB05.13	Understand the basic formulation and boundary conditions.	CO 5	Understand
	b	BAEB05.13	Understand the basic formulation and boundary conditions.	CO 5	Remember
10	a	BAEB05.15	Discuss the preliminary considerations prior to establishing numerical solution.	CO 5	Understand
	b	BAEB05.13	Understand the basic formulation and boundary conditions.	CO 5	Understand

Signature of Course Coordinator **HOD, AE**