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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - I

M.Tech I 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)	Discuss in brief about flux approach and list out the steps for setting up boundary layer equations.	**[7M]**
	b)	Explain upwind schemes and Mention the importance of first order upwind scheme.	**[7M]**
2.	a)	Explain the concept of flux vector splitting and Mention different types of vector split methods	**[7M]**
	b)	Differentiate Godunov's first order upwind method and Roe's first order upwind method.	**[7M]**

UNIT – II

3.	a)	Compare the forward-time forward space method and forward-time central space method.	**[7M]**
	b)	Discuss Cranck-Nikolson method as implicit approach by the numerical calculation.	**[7M]**
4.	a)	Briefly explain the leap-frog method in detail with the help of neat sketch.	**[7M]**
	b)	List the difference between time split methods and approximate factorization.	**[7M]**

UNIT – III

5.	a)	Discuss the concept of input and output boundary and list its differences.	**[7M]**
	b)	List out the differences in injection boundary and periodic boundary. Explain interface between grids and the concept of far-field.	**[7M]**
6.	a)	Discuss the flow gradients at boundaries of unstructured grids.	**[7M]**
	b)	Define viscous flow. Explain the solid wall in viscid flow and compare it with viscous flow.	**[7M]**

UNIT – IV

7.	a)	Define compatibility equation. Explain the importance of characteristic lines and its effect in fluid dynamics.	**[7M]**

b) Discuss how to produce the method of unit process for the conditions at wall, internal flow and shock wave. **[7M]**

8. a) Discuss the design of the supersonic wind tunnel nozzle by using the method of characteristics. **[7M]**
   b) Explain the two dimensional irrotational flow with the suitable diagram. **[7M]**

UNIT – V

9. a) Construct the steps for reducing a problem into set of linear algebraic equation. **[7M]**
   b) List out the steps in detail for solving the two dimensional doublet distribution of constant strength using Neumann conditions. **[7M]**

10. a) Explain the preliminary considerations prior to establishing the numerical solution. **[7M]**
    b) Compare the velocity components at different cases for two dimensional constant strength for source distributions and doublet distributions. **[7M]**

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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	BAEB05.03	Emphasize on basic schemes to solve the differential equations.	CO 1	Understand
	b	BAEB05.03	Emphasize on basic schemes to solve the differential equations.	CO 1	Understand
2	a	BAEB05.02	Explain the Euler equations for the aerodynamic solutions computationally.	CO 1	Remember
	b	BAEB05.03	Emphasize on basic schemes to solve the differential equations.	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	Understand
4	a	BAEB05.06	Develop the approximate factorization schemes for time dependent methods.	CO 2	Remember
	b	BAEB05.06	Develop the approximate factorization schemes for time dependent methods.	CO 2	Understand
5	a	BAEB05.07	Illustrate to apply concepts of discretization and its application for implicit difference equation.	CO 3	Remember
	b	BAEB05.08	Distinguish implicit and explicit discretization and differentiation equations for the stability of solution.	CO 3	Understand
6	a	BAEB05.08	Distinguish implicit and explicit discretization and differentiation equations for the stability of solution.	CO 3	Understand
	b	BAEB05.07	Illustrate to apply concepts of discretization and its application for implicit difference equation.	CO 3	Remember
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	BAEB05.12	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	Remember
9	a	BAEB05.15	Discuss the preliminary considerations prior to establishing numerical solution.	CO 5	Remember
	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	Remember

Signature of Course Coordinator **HOD, AE**