BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH **SEMESTER : II**
BRANCH: SER (AERODYNAMICS) **SESSION : SP/2025**

SUBJECT: SR576 COMPRESSIBLE FLOWS

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	How does the area velocity relation dictates the shape of ducts for subsonic and supersonic flows. Also illustrate the example of the condition when these ducts are operated in combination. Describe the necessary conditions to define a diffuser or a nozzle for these two speeds.	[5]	1	3
Q.1(b)	Describe the process of isentropic subsonic and supersonic flow through a CD nozzle, illustrating the Mach number and pressure along the duct length and the mass flow characteristics for the operations.	[5]	1	3
Q.2(a)	What are the differences between a stationary and a moving shock wave. Also show that for unsteady adiabatic inviscid flow the total enthalpy is not constant.	[5]	2	4
Q.2(b)	For a left and right running wave describe the regions of rarefaction, condensation, expansion and compression	[5]	2	3
Q.3(a)	Describe and extract 10 features from the Deflection angle-Wave angle–Mach curve. Differentiate the curve for two-dimensional and axisymmetric bodies.	[5]	3	4
Q.3(b)	Illustrate the shock expansion theory and state its limitation, and specific application areas. Take an example of a double diamond aerofoil at some angle of attack and describe the flow features on it at every corner. Also write down the method of obtaining forces on such shape using Ackeret theory.	[5]	3	4
Q.4(a)	What do you understand by swallowing of shock in a supersonic wind tunnel. Write down the process of starting of tunnel describing the minute details of the shock travel inside it.	[5]	4	4
Q.4(b)	Explain the different operations of supersonic intake detailing the physical requirements of such operations and hence plot the performance curve at those operating conditions.	[5]	4	3
Q.5(a)	What do you understand by intake buzz. What are the different conditions according to you which may induce and influence the phenomena of buzzing in actual conditions.	[5]	4	4
Q.5(b)	Differentiate between dimensional analysis and the similarity rules applicable for transonic flows.	[5]	5	3

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