

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2024)

CLASS: BTECH
BRANCH: ME

SEMESTER : V
SESSION : MO/2024

SUBJECT: ME349 TURBOMACHINERY

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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Q.1	The resisting force F of a supersonic plane during flight can be considered as dependent upon the length of the aircraft L , velocity V , air viscosity μ , air density ρ and bulk modulus of air K . Express the functional relationship between these variables and the resisting force.	[5] 3	3
Q.2(a)	Explain the Euler turbine equation	[1] 1	1
Q.2(b)	A turbine model working under a head of 2 m runs at 170 rpm and has a diameter of 1 m. A prototype turbine develops 22 MW under a head of 250 m with a specific speed of 100. Calculate (i) the scale ratio and (ii) the power developed by the model.	[4] 4	4
Q.3	The mean diameter of the blades of an impulse turbine is 85 cm and the speed is 3200 rpm. The inlet nozzle angle is 20° and the ratio of blade speed to steam speed is 0.45. The blade velocity coefficient is 0.85. The outlet angle of blade is 2° less than the blade angle at the inlet. The steam flow is 9 kg/s. Draw the velocity triangles and determine the following: (i) Inlet blade angle (ii) Tangential thrust (iii) Power developed and blade efficiency.	[5] 4	4
Q.4(a)	Explain the purpose of staging and compounding in an impulse turbine.	[2] 2	2
Q.4(b)	What are the differences between impulse and reaction turbines?	[3] 1	1
Q.5(a)	Explain the working principle of a centrifugal compressor with different main components.	[3] 2	2
Q.5(b)	Explain slip in a centrifugal compressor and factors accounting for the slip factor.	[2] 2	2

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