

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

CLASS: MTECH  
BRANCH: SER

SEMESTER : III  
SESSION : MO/19

SUBJECT: SR612 AERODYNAMICS OF INTERNAL 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.
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- Q.1(a) Describe Kelvin's theorem and show different mechanism of changing circulation. [5]  
Q.1(b) Illustrate the circulation generation due to shock motion in a non-homogeneous medium. [5]
- Q.2(a) Describe the different stages of transition from laminar to turbulence. Hence classify the mechanism of the transition. [5]  
Q.2(b) Discuss the boundary layer behavior in a diffuser and hence show the influence of exit boundary layer blockage ( $2\delta_e^*/W_e$ ) on the change of pressure rise coefficient with the area ratio ( $AR=W_e/W_i$ ) where  $W_e$  is the height of the diffuser at exit and  $\delta_e^*$  is the displacement thickness at the diffuser exit. [5]
- Q.3(a) Show the differences between the steady and unsteady boundary layers. [5]  
Q.3(b) Explain briefly the Kelvin Helmholtz instability and thus show the significance of frequency in the instability estimation. [5]
- Q.4(a) Demonstrate the starting of a supersonic diffuser by the shock swallowing process. [5]  
Q.4(b) Show the significance of compound flow indicator for a multistream compressible flows inside a CD nozzle. [5]
- Q.5(a) Demonstrate the features of flow process in a Ramjet Engine with constant pressure heat addition in the combustion chamber. [5]  
Q.5(b) Illustrate a case where heat addition in a stream corresponds to generation of vorticity at the exit of the duct. [5]

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