INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Date: , Time: **2 Hours**, Full Marks: **30**, Department: **Aerospace Engineering**

No. of Students: **58**, **Mid-Semester** Examination (2016-17), Sub. No.: **AE21001**

Sub. Name: **Introduction to Aerodynamics**, 2nd Yr. B.Tech

1. What is the *Continuum Hypothesis* in fluids? Define the *Knudsen number*. {2+1 = 3}

2. For a steady, incompressible and inviscid fluid flow, derive the Bernoulli's equation. Discuss its application. Also, derive compressible form of the Bernoulli's equation. {2+1+2 = 5}

3. Define perfect gas. When does a real gas behave like a perfect gas? Discuss the effects of temperature on real gases on its deviation from a perfect gas. {1+1+3 = 5}

4. Stating suitable assumptions derive the differential form of continuity equation. Write its forms for, (a) incompressible, (b) steady state. {3+1+1 = 5}

5. Prove that for an inviscid, homogeneous flow with conservative body forces, the circulation around a closed fluid line remains constant with respect to time. {4}

6. A two-dimensional source of strength $4.0\ \frac{m^2}{s}$ is placed in a uniform flow of velocity $1.0\ m/s$ parallel to x −axis. Determine the flow velocity and its direction at $r = 0.8$ and $\theta = 140^o$. {8}

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