Assignment 2

Due by 21-06-21, 23:59:59 IST.

1. Choose all the correct answers among the following:
   - (a) System, Lagrangian description
   - (b) System, Eulerian description
   - (c) Contact, Lagrangian description
   - (d) Contact, Eulerian description
   - (e) No, the answer is incorrect.

2. The pressure terms in the Reynolds transport theorem are:
   - (a) The net rate of mass outflow through the entire control surface
   - (b) The time rate of change of mass within control volume
   - (c) The time rate of change of mass outside control volume
   - (d) No, the answer is incorrect.

3. The net rate of mass outflow through the entire control surface is:
   - (a) 2 m³/s
   - (b) 3 m³/s
   - (c) 0 m³/s
   - (d) No, the answer is incorrect.

4. Consider steady, incompressible flow through the device shown in Figure 1. Determine the magnitude and direction of the velocity vector that enters through:
   - (a) Point A
   - (b) Point B
   - (c) Point C
   - (d) No, the answer is incorrect.

5. An object is present in Figure 2 at the entrance to a 3 m-wide channel the velocity distribution is uniform with a velocity $v_x$. Further downstream, the velocity $v_x$ profile is given by $v_x = \frac{v}{x}$ where $v_x = 5 m/s$ and $x = 0 m$. Determine the value of $v_x$.

6. Which of the following form of differential mass balance equation is valid for compressible flow at steady state?
   - (a) $\rho \frac{d}{dt} \left( \frac{v}{\rho} \right) = 0$
   - (b) $\rho \frac{d}{dt} \left( \frac{v}{\rho} \right) = 0$
   - (c) No, the answer is incorrect.

7. The component of velocity in a steady, incompressible flow field in the $x$-axis is given by $v_x = 4 + x$ (m/s) and it is measured in meters.
   - Find the transverse component of velocity for the flow field.

8. The three components of velocity in a steady flow field are given by $v_x = 1 + 2x + 3y$, $v_y = 3x + 2y + 4z$, $v_z = 5x + 4y + 3z$. Determine the relationship among the components. Is it necessary for them to be a potential incompressible flow field?