Assignment 7

The due date for submitting this assignment has passed. Due on 2019-03-20, 23:59 IST.
As per our records you have not submitted this assignment.

1) Euler’s equation of motion is a statement of
   (a) mass conservation
   (b) mechanical energy balance
   (c) conservation of linear momentum for a real fluid
   (d) conservation of linear momentum for the flow of an inviscid fluid

   No, the answer is incorrect.
   Score: 0
   Accepted Answers: (d)

2) Bernoulli’s theorem deals with the law of conservation of
   (a) mass
   (b) momentum
   (c) mechanical energy
   (d) concentration

   No, the answer is incorrect.
   Score: 0
   Accepted Answers: (c)

3) Each term of Bernoulli’s equation stated in the form \( \frac{p}{\rho} + \frac{V^2}{2} + gz = \text{constant} \) (where \( p \) is the pressure, \( \rho \) is the density, \( V \) is the velocity, \( z \) is the elevation, \( g \) is the acceleration due to gravity, and \( \text{constant} \) is a constant).

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No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

4) A rectangular chip floats on the top of a thin layer of air, above a bottom plate (Fig. 1). Air blown at a uniform velocity \( v_0 \) through holes in the bottom plate. Width of the perpendicular to the plane of the figure is \( L \). For steady, inviscid, constant density flow, the weight of the chip that can be held in equilibrium by the air injected is

\[
\begin{align*}
(a) \quad W &= \frac{\rho v_0^2 b^3 L}{12 h^2} \\
(b) \quad W &= \frac{\rho v_0^2 b^3 L}{2 h^3} \\
(c) \quad W &= \frac{\rho v_0^2 b^3 L}{3 h} \\
(d) \quad W &= \frac{\rho v_0^2 b^3 L^2}{4 h^3}
\end{align*}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

5)
See the demonstration of an inviscid, steady, constant density flow-field below.

\[
\frac{p_1}{\rho} + \frac{V^2_1}{2} + gz_1 = \frac{p_2}{\rho} + \frac{V^2_2}{2} + gz_2
\]

Which among the below statements is correct regarding the application of Bernoulli’s equation in this case:
(a) One cannot apply Bernoulli’s equation between points 1 and 2 since they are not on the same streamline.
(b) One can apply Bernoulli’s equation between points 1 and 2 when the flow is irrotational, even though the points are on different streamlines.
(c) Both (a) and (b) are wrong.
(d) None of the above.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

1 point

6)

The water level of a tank on a building roof is 20 m above the ground. A hose leads from the tank bottom to the ground. The end of the hose has a nozzle, which is pointed straight up. The maximum height (h_{max}) to which the water could rise is:
(a) h_{max} = 20 m if frictional effects are not neglected
(b) h_{max} = 20 m if frictional effects are neglected
(c) h_{max} < 20 m if frictional effects are present in the system.
(d) Both (b) and (c) are correct.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

1 point

7)

An engineer makes a statement: - “An irrotational flow is necessarily inviscid in nature.”
Now what is your opinion about this statement?
(a) It is a correct statement as long as it is ensured that viscosity is strictly zero everywhere in the flow.
(b) It is a wrong statement since irrotionality doesn’t always ensure that the flow is inviscid.
(c) It is a correct statement since irrotionality ensures that the flow is inviscid too.
(d) Both (a) and (b) are correct.
8) A hollow cylinder 0.6 m diameter, open at the top, contains some liquid and spins about a vertical axis, producing a forced vortex motion.

![Diagram](https://example.com/diagram.jpg)

(The situation when liquid just begins to uncover the base)

The height of the vessel so that the liquid just reaches the top of the vessel and begins to uncover the base at 100 rpm is given by acceleration due to gravity $g = 9.81 \text{ m/s}^2$.

(a) 1.06 m
(b) 2.12 m
(c) 0.503 m
(d) 0.106 m

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

9) In the physical situation described in the previous problem, if the speed is increased to 130 rpm, what area of the base will be uncovered?

(a) 0.116 m²
(b) 0.232 m²
(c) 0.464 m²
(d) 0.058 m²

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

10)
\[ \frac{p_1}{\rho g} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\rho g} + \frac{V_2^2}{2g} + z_2 \] (where \( p \) is the pressure, \( \rho \) is the density, \( V \) is the velocity, \( z \) the elevation, \( g \) is the acceleration due to gravity) is applicable between two points 1 and 2 in flow field under the following assumptions:

(a) steady, constant density, inviscid flow along a streamline
(b) steady, constant density, inviscid, and irrotational flow
(c) steady, constant density, inviscid flow and \( \vec{V} \times \vec{E} \) is perpendicular to \( d\vec{r} \) connecting 1 and 2.
(d) all three are correct

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

11) A tornado may be modeled as a combination of vortices with \( V_x = V_y = 0 \) and \( V_z = V_z(r) \), that \( V_r = ar^b \) (for \( r \leq R \)) and \( V_r = ar^b / r \) (for \( r \geq R \)) (see figure below).

The flow pattern can be characterized as

(a) The flow pattern is irrotational in the inner region but rotational in the outer region.
(b) The flow pattern is rotational in the inner region but irrotational in the outer region.
(c) The flow pattern is irrotational in both the inner and outer region.
(d) The flow pattern is rotational in both the inner and outer region.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

12)
The pressure distribution can be obtained as:

(a) for inner region: \( p(r) = p_a - \rho \omega^2 R^2 - \rho \omega^2 \frac{R^2 - r^2}{2} \); for outer region: \( p(r) = p_a - \frac{1}{2} \rho \omega^2 r \)

(b) for inner region: \( p(r) = p_a - \frac{1}{2} \rho \omega^2 R^2 - \rho \omega^2 \frac{R^2 - r^2}{2} \); for outer region: \( p(r) = p_a + \frac{1}{2} \rho \omega^2 r \)

(c) for inner region: \( p(r) = p_a - \rho \omega^2 \frac{R^2 - r^2}{2} \); for outer region: \( p(r) = p_a - \frac{1}{2} \rho \omega^2 r^2 \)

(d) for inner region: \( p(r) = p_a - \frac{1}{2} \rho \omega^2 R^2 - \rho \omega^2 \frac{R^2 - r^2}{2} \); for outer region: \( p(r) = p_a - \frac{1}{2} \rho \omega^2 r \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

In the previous problem the location and magnitude of the overall lowest pressure are:

(a) The overall minimum pressure is at \( r = R \) the center and its value is \( p_{\text{min}} = p_a - \rho \omega^2 R^2 \)

(b) The overall minimum pressure is at the center and its value is \( p_{\text{min}} = p_a - \rho \omega^2 R^2 \)

(c) The overall minimum pressure is at \( r = R \) and its value is \( p_{\text{min}} = p_a - \frac{1}{2} \rho \omega^2 R^2 \)

(d) The overall minimum pressure is at the center and its value is \( p_{\text{min}} = p_a - \frac{1}{2} \rho \omega^2 R^2 \).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)