FLUID MECHANICS

TESTS

Attention: there might be more correct answers to the questions.

Chapter 5: Vortex theorems

T.5.1.1 Which formulation of Thomson's vortex theorem is correct if rot$\underline{g}$=$\underline{0}$ ($\underline{g}$ is the field of force) and ρ=constant?

a, Circulation along a closed path is zero.

b,Circulation along a closed path is time-independent.

c, Circulation along a closed fluid path is time-independent.

d, In an inviscid fluid circulation is time-independent along a closed fluid path.

e, In a steady flow circulation is time-independent along a closed fluid path.

The answer is:

T.5.1.2 Which of the following assumptions must be fulfilled to be able to use the equation

$$\frac{\mathrm{d}}{\mathrm{d}t}\oint_C \underline{v}\mathrm{d}\underline{s} = 0$$

a,curve C is a fluid line

b,$\frac{\partial \underline{v}}{\partial t} = \underline{0}$

*c,*rot$\underline{v}$ = $\underline{0}$

*d,*rot$\underline{g}$ = $\underline{0}$

e, inviscid fluid

The answer is:

T.5.2.1 Choose the correct statement(s)!

a,The intersection of two vortex surfaces is a vortex line.

b, If an inviscid fluid of constant density flows from a field which is at rest, the flow is vortex-free, if the field force is vortex-free.

c, The vortex line is the envelope of the rot$\underline{v}$ *vectors.*

d, In an ideal fluid the vortex cylinder consists of the same fluid parts over time.

e, In an inviscid fluid, circulation (velocity integrated along a closed fluid path) increases in time.

The answer is:

TZ.5.1 Thomson’s theorem expresses that

a, In a flow, circulation is constant along an arbitrary closed path.

b, Circulation along a closed path equals to the integral of the vortex vectors on the surface surrounded by the path.

c, Temporal change of the velocity integrated along a closed fluid path is zero.

d, The line integral of velocity along a closed fluid path is zero.

e, Circulation along all closed paths is zero.

The answer is:

TZ.5.2 Necessary conditions for the validity of Thomson’s theorem are:

a, the flow has a potential

b, the fluid is incompressible

c, the fluid is inviscid

d, density is either constant or depends only on pressure

e, the field of force has a potential

The answer is: