

**COVENANT UNIVERSITY
NIGERIA**

*TUTORIAL KIT
OMEGA SEMESTER*

**PROGRAMME: MECHANICAL
ENGINEERING**

COURSE: GEC 223

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GEC 223: Fluid Mechanics

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1. What is a fluid?

Answer

A fluid is a substance which deforms continuously under the application of a shear stress.

2. Give a qualitative definition of stress
3. State the properties of stress

Answer

- Stresses have both magnitude (force per unit area) and direction, and the direction is relative to the surface on which the stress acts.
- There are normal stresses and tangential stresses.
- Pressure is an example of a normal stress, and acts inward, toward the surface, and perpendicular to the surface.
- A shear stress is an example of a tangential stress, i.e. it acts along the surface, parallel to the surface. Friction due to fluid viscosity is the primary source of shear stresses in a fluid.

4. Definition shear stress –
5. Define fluid mechanics

Answer

Fluid mechanics is the branch of physics which involves the study of fluids (liquids, gases, and plasmas) and the forces on them is the application of the laws of force and motion to fluids.

6. State the assumptions of fluid mechanics
7. Give examples of flow dependent transport processes or state some of the significance of fluid flow.

Answer

- Flow-dependent transport processes that supply our body with the oxygen that is essential to life.
- In the blood vessels of the human body, essential nutrients are transported by mass flows and are thus carried to the cells, where they contribute, by complex chemical reactions, to the build-up of our body and to its energy supply.
- Flows in rivers, lakes and seas have to be mentioned, and also atmospheric flow processes, whose influences on the weather and thus on the climate of entire geographical regions

- Devastations that hurricanes and cyclones can cause. When rivers, lakes or seas leave their natural beds and rims, flow processes can arise whose destructive forces are known
- Flow processes occur in instruments and machines to transfer energy, generate lift forces, run combustion processes or take on control functions e.g. fluid flows coupled with chemical reactions that enable the combustion in piston engines to proceed in the desired way and thus supply the power that is used in cars, trucks, ships and aero planes which overcomes the energy loss resulting from the flow resistance that the vehicle experiences owing to the momentum loss and the flow separations.
- In aerodynamics, new aeroplane wing profiles and wing geometries as well as wing body connections are developed which show minimal losses due to friction and collision while maintaining the high lift forces necessary in aeroplane aerodynamics.
- The optimization of products from the point of view of fluid mechanics has led to new markets, for example the production of ventilators for air exchange in rooms and the optimization of hair driers.
- In the field of chemical engineering, where many areas such as heat and mass transfer processes and chemical reactions are influenced strongly or rendered possible only by flow processes.

8. State the types of fluids

9. What are Newtonian fluids

Answer

A fluid that behaves according to Newton's law, with a viscosity μ that is independent of the stress, is said to be Newtonian. Newtonian fluids are fluids when the viscous stresses that arise from its flow, at every point, are proportional to the local strain rate — the rate of change of its deformation over time.

10. State the properties of ideal fluids

11. What is an ideal Ideal Fluid

Answer

An imaginary fluid that lacks viscosity and thermal conductivity. There is no internal friction in an ideal fluid—that is, there are no tangential stresses between two neighboring layers.

12. Define steady flow

13. State the governing equations for ideal fluid flow

Answer

(a) Continuity Equation, (b) Momentum (Navier-Stokes - Euler) equations:

14. State the differential form of the continuity equation

15. Mention some common application where the Equation of Continuity are used.

Answer

pipes, tubes and ducts with flowing fluids or gases, rivers, overall processes as power plants,

diaries, logistics in general, roads, computer networks and semiconductor technology and more

16. State the continuity equation

Answer

Continuity equation states that, in any steady state process, the rate at which mass enters a system is equal to the rate at which mass leaves the system.

17. State the continuity equation again

Answer

The Continuity Equation states that the cross-sectional area of the pipe and the velocity of the fluid are inversely proportional that is, fluids flow faster through narrower pipes.

18. Define flow velocity

19. State Pascals Law

Answer

Pascal's law or the principle of transmission of fluid-pressure is a principle in fluid mechanics that states that pressure exerted anywhere in a confined incompressible fluid is transmitted equally in all directions throughout the fluid such that the pressure variations (initial differences) remain the same.

20. Define fluid statics