

## **CEN 212 FLUID MECHANICS**

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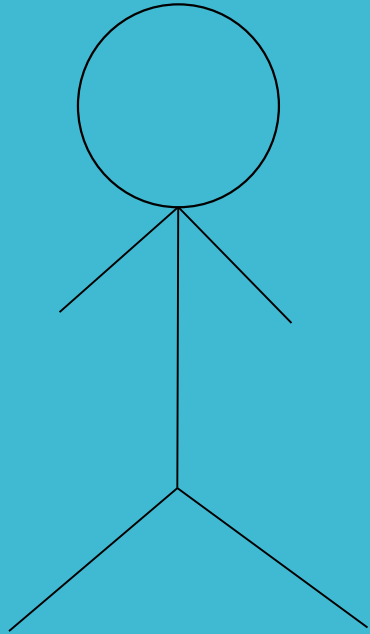
# COURSE CONTENT

- Course Content:
- 1. Introduction, Properties of fluids
- 2. Dimensional analysis, Fluid statics
- 3. Fluid statics
- 4. Fluid flow phenomena
- 5. Basic equations of fluid flow, Flow similarity
- 6. Laminar flow, Momentum balances
- 7. Boundary layers,
- 8. Mechanical energy equation
- 9. Friction, Pumps
- 10. Flow past immersed bodies, Packed beds
- 11. Metering of fluids
- 12. Agitation and mixing of liquids

# REFERENCES

- Text Book:
  1. Geankoplis C.J., Transport Processes and Unit Operation, 4th Edition, PTR Prentice Hall, 2003.
  
- Reference Books:
  1. McCabe, W.L., Smith, J.C., Harriott, P., Unit Operations of Chemical Engineering, 7th Edition, McGraw Hill, 2005.
  2. Fox, R.W., McDonald, A.T., Pritchard, P.J., Introduction to Fluid Mechanics, John Wiley & Sons, 6th Edition, 2003.
  3. Munson, B.R., Young, D.F., Okiishi, T.H., Fundamentals of Fluid Mechanics, 2nd Edition, 1994.
  4. Perry, R.H., Green, D., Perry's Chemical Engineers' Handbook, 7th ed., McGraw Hill, 1997

# FLUID MECHANICS IN CHEMICAL ENGINEERING



A chemical engineer **MUST**



Develop and design

Choose proper raw materials

Operate the plant efficiently, *SAFELY* and economically

See if the products meet the customer requirements

# FLUID MECHANICS IN CHEMICAL ENGINEERING

## Unit Operations:

Primarily physical steps of preparing the reactants.

Separating and purifying the products.

Recycling unconverted reactants.

Control the energy transfer.

- FLUID MECHANICS is the branch of science that deals with the macroscopic behavior of fluids (liquids, gases and vapors).
- Fluid Mechanics has two main areas of interest:
  1. Fluid Statics: Fluids in equilibrium state (no shear stress)
  2. Fluid Dynamics: Fluids in motion

# UNIT SYSTEMS

- System International (SI)

m, kg, s, K

- CGS

cm, g, s, K

- FPS

ft, lb, s, R

# MOLECULAR TRANSPORT

- All molecular transport processes depend on the same principle (driving force) and basic equations are analogous

MOMENTUM

HEAT

MASS

Newton's Law

Fourier's Law

Fick's Law

FLUID MECHANICS depends on the principles of MOMENTUM transport.

# PROPERTIES OF FLUIDS

- A fluid is a substance that does not permanently resist distortion and hence will change its shape.
- Gases, liquids and vapors are considered to have the characteristics of fluids

Liquids  incompressible

Gases  compressible