ENGR 335

KEY WORDS FOR CH 9

surface resistance
skin-friction drag
form drag

Couette flow
inclined plane flow
slot flow

momentum integral method

boundary layer
laminar boundary layer
turbulent boundary layer
boundary layer thickness
local wall shear stress
local shear stress coef.
total shear stress coef.
total surface resistance

separation
boundary layer control

turbulence model
viscous sublayer
logarithmic layer
velocity defect layer
power law model

leading edge
boundary layer trip

KEY WORDS FOR CH 11

drag force
lift force
skin-friction drag
form drag
pressure drag
drag crisis

angle of attack
lift coefficient
planform area

two-dimensional body
end effects
bluff body
slender body
axisymmetric body

wing tip vortices
stall
camber

drag coefficient
projected area

vortex shedding

terminal velocity

STUDY QUESTIONS

1. Each of the following fully developed flows have a balance between the fluid weight, the surface resistance, and/or the pressure forces: (i) flow down an inclined plane, (ii) Couette flow, and (iii) pressure driven flow between parallel plates. Which forces act in each of these flows?

2. Give an example of flow over an object where the skin-friction drag is negligible. Give an example of flow over an object where the form drag is negligible.

3. Where is the local shear stress in a boundary layer the largest? Why?

4. For which objects in figure 11.11 is the drag coefficient roughly constant over fairly wide range of Reynolds number? Why do you think that this is the case?

5. You are asked to **estimate** the force that a river exerts on a column that supports a navigation device. Describe your approach.