**Birzeit University – Mechanical & Mechatronics Engineering Department**

**Fluid Mechanics-ME335**

**Suggested problems Chapter 1**

**Instructors: Dr. Afif Akel Hasan Summer 2018/2019**

**P1.45** A block of weight *W* slides down an inclined plane while lubricated by a thin film of oil, as in Figure. The film contact area is *A* and its thickness is *h*. Assuming a linear velocity distribution in the film.

1. Derive an expression for the “terminal” (zero-acceleration) velocity *V* of the block.
2. Find the terminal velocity of the block if the block mass is 6 kg, *A* = 35 cm2, θ = 15°, and the film is 1-mm-thick SAE 30 oil at 20°C.



**P1.56** The device in Fig. P1.56 is called a *cone-plate viscometer.* The angle of the cone is very small, so that sin θ=θ, and the gap is filled with the test liquid. The torque *M* to rotate the cone at a rate Ω is measured. Assuming a linear velocity profile in the fluid film, derive an expression for fluid viscosity μ as a function of (*M*, *R*, Ω , θ).



**P1.70** Derive an expression for the capillary height change *h* for a fluid of surface tension *Y* and contact angle θ between two vertical parallel plates a distance *W* apart, as in Figure. What will *h* be for water at 20°C if *W* = 0.5 mm?

