Possible questions for the final exam – CEE 3500 – Fall 2005
Part 1 – Fluid properties, Statics

[1]. What is the basic unit of force in the British Gravitational (BG) system of units?

[2]. What is the basic unit of mass in the British Gravitational (BG) system of units?

[3]. What is the basic unit of force in the International System (SI) of units?

[4]. What is the basic unit of mass in the International System (SI) of units?

[5]. If \( m \) is the mass of a fluid and \( V \) is its volume, the density \( \rho \) of this fluid is calculated as:
   (a) \( V/m \)  (b) \( m/g \)  (c) \( m/V \)  (d) \( mg \)

[6]. If \( \rho \) is the density of a fluid, the specific volume is defined as:
   (a) \( 1/\rho \)  (b) \( \rho g \)  (c) \( g/\rho \)  (d) \( \rho /g \)

[7]. If \( W \) is the weight of a volume \( V \) of a liquid, then, the specific weight of a liquid, \( \gamma \), is given by:
   (a) \( V/W \)  (b) \( W/g \)  (c) \( W/V \)  (d) \( Wg \)

[8]. If a force \( F \) acts on a surface \( A \), then the pressure \( p \) on the surface is defined as:
   (a) \( F/A \)  (b) \( A/F \)  (c) \( AF \)  (d) \( F/A^2 \)

[9]. The bulk modulus of elasticity of a liquid has units of:
   (a) volume  (b) pressure  (c) force  (d) viscosity

[9]. An ideal fluid is one with zero viscosity. Thus, an ideal fluid is also known as a(n):
   (a) incompressible fluid  (b) viscous fluid  (c) inviscid fluid  (d) compressible fluid

[10]. If \( \mu \) is the absolute (or dynamic) viscosity of a fluid and \( \rho \) is its density, its kinematic viscosity is defined as:
    (a) \( \rho VD/\mu \)  (b) \( \rho g \)  (c) \( \mu \rho \)  (d) \( \mu /\rho \)

[11]. Which one of the following is a unit of absolute viscosity?
    (a) centipoise  (b) newton  (c) pascal  (d) watt

[12]. Which one of the following is a unit of kinematic viscosity?
    (a) poise  (b) newton  (c) centistoke  (d) watt

[13]. Which one of the following is a unit of pressure?
    (a) centipoise  (b) newton  (c) pascal  (d) watt

[14]. Which one of the following is a unit of power?
    (a) centipoise  (b) newton  (c) pascal  (d) watt
[15]. The horsepower (hp) is a BG unit of:
   (a) energy  (b) force  (c) pressure  (d) power

[16]. __ True or __ False: Kinematic viscosity has dimensions of \( \text{length}^2/\text{time} \) (\( \text{L}^2/\text{T} \)).

[17]. __ True or __ False: Surface tension has dimensions of \( \text{Force}/\text{length} \) (\( \text{F}/\text{L} \)).

[18]. \( \text{N s/m}^2 \) are units of __________ in the SI.
   (a) pressure  (b) absolute viscosity (c) kinematic viscosity (d) kinetic energy

[19]. __ True or __ False. The effect of water rising in small-diameter tubes due to surface tension is referred to as capillarity.

[20]. __ True or __ False. Water is a wetting liquid.

[21]. __ True or __ False. Mercury is a non-wetting liquid.

[22]. Let \( p_{\text{abs}} \) be the absolute pressure at a point, \( p_{\text{gage}} \) be the gage pressure, and \( p_{\text{atm}} \) be the atmospheric pressure at the same point. The absolute pressure is calculated as:
   (a) \( p_{\text{abs}} = p_{\text{gage}} + p_{\text{atm}} \) (b) \( p_{\text{abs}} = p_{\text{gage}} - p_{\text{atm}} \) (c) \( p_{\text{abs}} = p_{\text{atm}} - p_{\text{gage}} \) (d) \( p_{\text{abs}} = p_{\text{atm}} / p_{\text{gage}} \)

[23]. To convert from \( \text{psi} \) (pounds per square inch, or \( \text{lb/in}^2 \)) to \( \text{psf} \) (pounds per square foot, or \( \text{lb/ft}^2 \)) multiply by:
   (a) 12  (b) 32.2 (c) 9.806 (d) 144

[24]. Which of the following is not a typical value of the atmospheric pressure at sea level:
   (a) 14.69 psi  (b) 300 mmHg  (c) 101.3 kPa  (c) 10.34 mH₂O

[24]. Atmospheric pressure can be measured using an instrument called:
   (a) rotameter  (b) pitot tube  (c) barometer  (d) hot-wire anemometer

[25]. Pressure differences in a pipeline can be measured using an instrument called:
   (a) rotameter  (b) manometer  (c) barometer  (d) hot-wire anemometer

[26]. The Bourdon Gage is an instrument used to measure:
   (a) horsepower  (b) velocity  (c) pressure  (d) discharge

[27]. Let \( z \) represent the elevation of the centerline of a pipe and \( p \) be the pressure at the pipe section, the sum \( z + p/\gamma \), where \( \gamma \) is the specific weight of the fluid in the pipe, is referred to as the:
   (a) manometric pressure  (b) elevation  (c) velocity head  (d) piezometric head

[28]. If we are working with gage pressures only in analyzing a manometer, any free surface open to the atmosphere has a pressure equal to:
   (a) 14.69 psi  (b) zero  (c) 760 mmHg  (d) 101.3 kPa
[29]. True or False. The equation $p = \gamma h$ represents the gage pressure at a depth $h$ below the free surface of a liquid of specific weight $\gamma$ open to the atmosphere.

[30]. If a horizontal plane surface of area $A$ is submerged at a depth $h$ in a liquid of specific weight $\gamma$ the force due to the liquid pressure on the area is calculated as:

(a) $\gamma hA$  (b) $\gamma h/A$  (c) $A/\gamma h$  (d) $\gamma h + A$

[31]. If a vertical plane surface of area $A$ is submerged in a liquid of specific weight $\gamma$, and $h_c$ is the depth of the surface's centroid below the free surface, then, the force due to the liquid pressure on the area is calculated as:

(a) $A/\gamma h_c$  (b) $\gamma h_c A$  (c) $A/\gamma h_c$  (d) $\gamma h_c + A$

[32]. The point on a plane surface where the hydrostatic force acts is referred to as:

(a) the center of gravity  (b) the centroid  (c) the center of mass  (d) the center of pressure

[33]. True or False: The buoyancy force on a solid submerged in a fluid is equal to the weight of the volume of liquid displaced by the solid.

[34]. True or False: Archimedes' principle is used to calculate the buoyancy force on a solid submerged in a liquid.

[35]. True or False: If a nonporous solid has a specific weight (or density) larger than that of the liquid where it is submerged the solid body will sink in the liquid.

[36]. True or False: If a nonporous solid has a specific weight (or density) smaller than that of the liquid where it is submerged the solid body will float to the surface of the liquid.

[37]. A hydrometer can be used to measure the _______________ of a liquid.

(a) viscosity  (b) specific gravity  (c) surface tension  (d) bulk modulus of elasticity