Universitas Gadjah Mada
Fakultas Teknik
Departemen Teknik Sipil dan Lingkungan

Program Sarjana
Program Studi Teknik Sipil
Semester Gasal TA. 2024/2025

Soal Ujian Tengah Semester

Mata Kuliah : Mekanika Fluida (TKSS211208)
Hari & Tanggal : Senin, 30 September 2024
Waktu : 120 menit, selembar *cheatsheet*
Dosen : Nizam
Vempi Satriya Adi Hendrawan

1. Units and Dimensions (20 points). SO a.1, b.1

a. Convert 50 m^3/s to liters per minute. *(5 points)*
b. The drag force F on a body moving through a fluid is given by the equation: $F = \frac{1}{2}\rho V^2 C_D A$, where ρ is fluid density, V is velocity, C_D is the drag coefficient, and A is the projected area. Determine the dimensions of the drag coefficient C_D. *(7 points)*
c. State the principle of dimensional homogeneity and explain its importance in fluid mechanics equations. *(8 points)*

2. Hydrostatics (20 points). SO a.1, a.2, a.3

a. A rectangular gate 3 m wide and 2 m high is submerged vertically in water. The top edge of the gate is 1 m below the water surface. Calculate:
   i) The hydrostatic force on the gate. *(5 points)*
   ii) The location of the center of pressure. *(5 points)*
b. Explain the concept of pressure and how it differs from force. How does pressure vary with depth in a static fluid? *(10 points)*

3. Fluid in an accelerated container and centrifuge (20 points). SO a.1, a.2, a.3

a. A cylindrical tank with a radius of 2 m contains water to a depth of 3 m. If the tank is rotated about its vertical axis at 30 rpm, determine:
   i) The shape of the water surface. *(5 points)*
   ii) The maximum and minimum depths of water in the rotating tank. *(10 points)*
b. Briefly explain how the surface of a liquid in an accelerating container differs from that in a stationary container. *(5 points)*

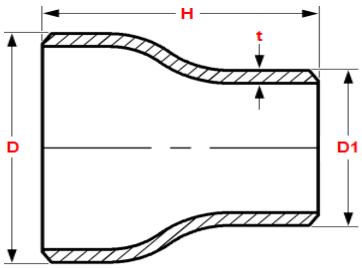
4. Buoyancy and Static Stability (20 points). SO a.1, a.2, a.3

a. A rectangular barge with a width of 5 m, length of 20 m, and height of 4 m weighs 50 tons when empty. It is loaded with 200 tons of goods and is floating in seawater (density 1025 kg/m^3). Calculate:
   i) The draft of the barge (depth of submersion) when loaded. *(5 points)*
   ii) The freeboard (distance from the water surface to the top of the barge) when loaded. *(3 points)*
   iii) The metacentric height if the center of gravity of the loaded barge is 2.2 m above the

base. Assume the metacenter is at the water surface. *(7 points)*

b. If a wave causes the barge to roll slightly:
   i) Explain whether the barge will return to its original position, continue to roll further, or remain in its new position. *(3 points)*
   ii) Calculate the righting moment when the barge is tilted by 5 degrees. *(2 points)*

5. Bernoulli Equation (20 points). SO a.1, a.2, a.3



Reducer concentric

a. Water flows through a horizontal pipe that narrows from a diameter D of 10 cm to D_1 of 5 cm. If the velocity in the larger section is 2 m/s, calculate:
   i) The velocity in the smaller section. *(5 points)*
   ii) The pressure difference between the two sections, assuming no energy losses. *(10 points)*

b. State the assumptions made in deriving the Bernoulli equation and discuss one practical application of this principle in engineering. *(5 points)*

Note: Harap dikerjakan sendiri-sendiri, It's not the time to work in group! Percayalah pada diri Anda sendiri. Kumpulkan *cheatsheet* bersama lembar jawaban.

Dosen Penguji I	Dosen Penguji II	Diperiksa oleh Dosen Koordinator	Diketahui oleh Kaprodi T Sipil
			
Prof. Nizam	Vempi Satriya Adi Hendrawan, Ph.D.	Prof. Bambang Agus Kironoto	Karlina, Ph.D.