KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2018

Level : B. E.
Year : II
Course : CHEG 212
Semester: II
Exam Roll No.:
Time: 30 mins.
F.M. : 10
Registration No.:
Date : DEC 30 2018

SECTION "A"
[20 Q.×0.5=10 marks]

Tick the most appropriate answer

1. With increasing flow rate, the hydraulic efficiency of a centrifugal pump
   a. Remains constant
   b. Monotonically decreases
   c. Decreases and then increases
   d. Increases and then decreases

2. The fluid property, due to which, mercury does not wet the glass is
   a. Adhesion b. Cohesion c. Viscosity d. Surface tension

3. The velocity profile for turbulent flow through a closed conduit is
   a. Parabolic b. Linear c. Hyperbolic d. Logarithmic

4. Nominal size of the discharge pipe of a pump is usually _____ the nominal size of the inlet pipe.
   a. Twice b. Smaller than c. Larger than d. Same as

5. Which of the following denotes the effect of compressibility in fluid flow?
   a. Euler number b. Mach number c. Weber number d. Reynolds number

6. At high Reynolds number
   a. Inertial forces are unimportant and viscous forces control
   b. Viscous forces predominate
   c. Inertial forces control and viscous forces are unimportant
   d. None of these

7. The Newtonian fluid flow through circular pipe and flow charectristics changes from Laminar to Turbulent, when the Reynolds number exceeds by
   a. 3000 b. 2100 c. 4000 d. 1500

8. Power loss in an orificemeter is _____ that in a venturimeter.
   a. Less than
   b. Same as
   c. More than
   d. Data insufficient, cannot be predicted

9. If the discharge of a centrifugal pump is throttled, then its suction lift
   a. Increases
   b. Decreases
   c. Remains unchanged
   d. Data insufficient to predict

10. The net positive suction head (NPSH) of a centrifugal pump is defined as the sum of the velocity head and the pressure head at the
a. Discharge minus vapor pressure of the liquid at the discharge temperature
b. Discharge
c. Suction
d. Suction minus vapor pressure of the liquid at suction temperature

11. The terminal velocity of a particle moving through a fluid varies as D_p^n, what is the value of n' for Newton's law regime?
a. 0.5 b. 1 c. 2 d. 1.5

12. Most commonly used joint in the underground pipe lines is the
a. Sleevejoint b. Flange c. Expansion joint d. Coupling

13. The fluid, in which the shearing stress within it is proportional to the velocity gradient across the sheared section, is called a _____ fluid.
a. Perfect b. Newtonian c. Bingham d. None of these

14. The line of action of the buoyant force passes through the centre of gravity of the
a. Horizontal projection of the body
b. Submerged body
c. Displaced volume of the fluid
d. Volume of fluid vertically above the body

15. For a particle settling in water at its terminal settling velocity, which of the following is true?
a. Drag = weight
b. Drag = buoyancy + weight
c. Weight = buoyancy + drag
d. Buoyancy = weight + drag

16. Pick out the correct statement
a. A forced vortex occurs when fluid rotates as a solid about an axis.
b. In turbulent flow, there are neither cross-currents nor eddies.
c. In laminar flow, Newton's law of viscosity does not apply.
d. A free vortex occurs, when fluid rotates as a solid.

17. What causes cavitation in centrifugal pump?
a. High suction pressure
b. Low barometric pressure
c. Low suction pressure
d. High suction velocity

18. Drag force acting on a body does not depend upon the
a. Density of the fluid
b. Density of the body
c. Velocity of the body
d. Projected area of the body

19. Very small pressure difference (< 5 mm water column) can be most conveniently measured by a/an _____ manometer.
a. U-tube water b. U-tube mercury c. Inclined tube water d. Inclined tube mercury

20. For ideally incompressible fluid, the Mach number will be
a. 1 b. 5 c. 2 d. 1.5

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SECTION "B"

Attempt ***ALL*** questions.

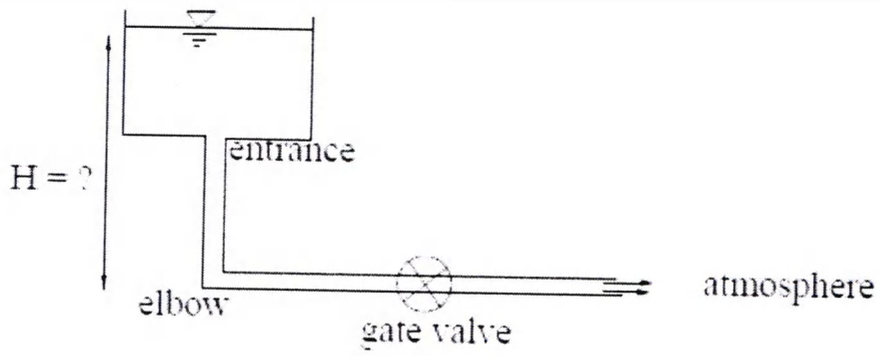
1. Derive Bernoulli's equation for flow through a straight pipe. [6]

2.a. Bring out the importance of the relation between the shear stress and velocity gradient in characterizing the behavior of flowing fluids. [3]

b. A steady flow field of an incompressible fluid is given by $\vec{v} = (Ax + By)i - (Ay)j$, where A = 1 s^{-1}, B = 1 s^{-1}, and x, y are in meter. What is the magnitude of the acceleration (in m/s^2) of a fluid particle at (1,2)? [3]

3. A fluidized bed (0.5 m dia, 0.5 m high) of spherical particles (diameter = 2000 μm, specific gravity = 2.5) uses water as the medium. The porosity of the bed is 0.4. The Ergun equation for the system is $\Delta p/L = 4 \times 10^5 v_{mf} + 1 \times 10^7 v_{mf}^2$ (SI unit, v_{mf} in m/s). Find the value of $\Delta p/L$ at minimum fluidization condition and also find the minimum fluidization velocity. [6]

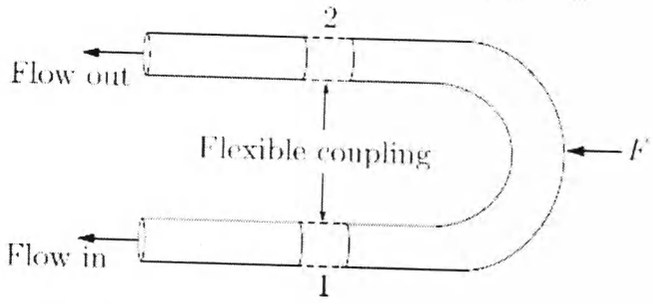
4. Consider a water tank which is connected to a pipe system as shown in figure. The pipe walls are smooth, and the pipe system has a sharp-edged entrance, one 90° elbow, and a fully open gate valve. Water exits from the pipe to atmospheric pressure. The pipe diameter is 5 cm, and the total length of the pipe is 1 m. Calculate the minimum height H of the water in the tank above the pipe system discharge (H shown in the figure), such that the Reynolds number of flow in the pipe is 10^5. [6]



OR

Derive the Hagen-Poiseuille equation for laminar flow through a circular pipe. State the limitations of the equation.

5. The figure shows the idealized view of a return elbow or U bend, which is connected to two pipes by flexible hoses that transmit no force. Water with density 1000 kg/m^3 flow at velocity of 10 m/s through the pipe, which has a uniform ID of 0.1 m. The gauge pressure at points 1 and 2 are 304 kPa and 253 kPa respectively. What is the horizontal force F required to keep the elbow in the same position? [6]



6. Show that the average velocity of the fluid flowing through a circular pipe under laminar conditions is half that of the maximum velocity. [6]

7. The steady velocity profile in the fully-developed region of the cylindrical tube, neglecting entrance and exit effects. Give brief reasons for why certain terms are neglected in the Navier-Stokes equations. [4]

OR

Distinguish between kinetic energy correction factor and momentum correction factor.