NPTEL Quiz
Hydraulics

Introduction

1. An ideal fluid is
   a. One which obeys Newton’s law of viscosity
   b. Frictionless and incompressible
   c. Very viscous
   d. Frictionless and compressible

   Ans: b

2. The unit of kinematic viscosity is
   a. gm/cm-sec²
   b. dyne/cm²-sec
   c. gm/cm²-sec
   d. cm²/sec

   Ans: d

3. The viscosity of a gas
   a. Decreases with increase in temperature
   b. Increases with increase in temperature
   c. Is independent of temperature
   d. Is independent of pressure for very high pressure

   Ans: b

4. Newton’s law of viscosity relates
   a. Intensity of pressure and rate of angular deformation
   b. Shear stress and angular deformation
   c. Shear stress viscosity and temperature
   d. Viscosity and rate of angular deformation

   Ans: b
5. The kinematic viscosity is the
   a. ratio of absolute viscosity to the density of the liquid
   b. ratio of density of the liquid to the absolute viscosity
   c. product of absolute viscosity and density of the liquid
   d. product of absolute viscosity and mass of the liquid

   Ans: a

6. The value of bulk modulus of a fluid is required to determine
   a. Reynold's number
   b. Froude's number
   c. Mach number
   d. Euler's number

   Ans: c

7. Specific volume is reciprocal of
   a. Weight density
   b. Mass density
   c. Specific gravity
   d. Density

   Ans: b

8. The absolute viscosity $\mu$ of a fluid is primarily a function of
   a. Density
   b. Temperature
   c. Pressure
   d. Velocity

   Ans: b

9. Newtonian fluid is a fluid
   a. Which is highly viscous
   b. Which obeys Newton’s law of viscosity
   c. Frictionless and compressible
   d. Frictionless and incompressible

   Ans: b
10. Surface tension has the unit of
   a. Force per unit area
   b. Force per unit length
   c. Force per unit density
   d. Force per unit volume

   Ans: b

11. Vapour pressure of liquid------ with temperature
   a. Increases
   b. Decreases
   c. Remain constant

   Ans: a

12. Hydraulic grade line for flow in a pipe of constant diameter is
   a. Always above the centerline of the pipe.
   b. Always above the energy grade line
   c. Always sloping downward in the direction of the flow.
   d. Coincides with the pipe centerline

   Ans: c

13. The head loss in a sudden expansion from 6cm diameter pipe to 12cm diameter pipe in terms of velocity $V_1$ in the 6cm pipe is
   a. $15/16 \frac{V_1^2}{2g}$
   b. $3/4 \frac{V_1^2}{2g}$
   c. $1/4 \frac{V_1^2}{2g}$
   d. $9/16 \frac{V_1^2}{2g}$

   Ans: d

14. The head loss caused due to sudden expansion from $A_1$ to area $A_2$ causing velocity to change from $V_1$ to $V_2$ is
   a. $(1- \frac{A_1}{A_2})^2 \frac{V_1^2}{2g}$
   b. $(1- \frac{A_1}{A_2})^2 \frac{V_2^2}{2g}$
   c. $(1- \frac{A_1}{A_2})^2 \frac{V_2^2}{2g}$
   d. $(1- \frac{A_1}{A_2}) \frac{V_2^2}{2g}$

   Ans: a
15. The minor loss due to sudden contraction is due to
   a. Flow contraction
   b. Expansion of flow after sudden contraction
   c. Boundary friction
   d. Cavitation

   Ans: b

16. Non uniform flow occurs when
   a. The direction and magnitude of the velocity at all points are identical.
   b. The velocity of successive fluid particles, at any point is the same at successive periods
      of time.
   c. The magnitude and direction of the velocity do not change from point to point in the
      fluid.
   d. The fluid particles move in plane and streamline patterns are identical in each plane

   Ans: c

17. The flow of liquid at constant rate in a conically tapered pipe is classified as
   a. Steady, uniform flow
   b. Steady, non uniform flow
   c. unsteady, uniform flow
   d. unsteady, non uniform flow

   Ans: b

18. A pathline is the
   a. Mean direction of a number of particles at the same instant of time.
   b. Instantaneous picture of position of all particles in the flow which passed a given point.
   c. Trace made by single particle over a period of time
   d. Path traced by continuously injected tracer at a point.

   Ans: d
19. Uniform flow occurs when
   a. Flow is steady
   b. The flow is streamlined
   c. Size and shape of the cross section in a particular length remain constant
   d. Flow occurs at constant rate.

   Ans: c

20. Gradually varied flow is
   a. Steady uniform
   b. Non steady non uniform
   c. True one dimensional
   d. Steady non uniform

   Ans: d

21. A line, the tangent to which at any point gives the direction of motion at that point, is called as
   a. Streak line
   b. Path line
   c. Stream line
   d. Vortex line

   Ans: c

22. A flow in which the velocities of liquid particles at all sections of the pipe or channel are equal is called as
   a. Uniform flow
   b. Laminar flow
   c. Turbulent flow
   d. Unsteady flow

   Ans: a
23. When various fluid particles move in layers with one layer of fluid sliding smoothly over
the adjacent layer, then the flow is said to be
a. Laminar flow
b. Uniform flow
c. Steady flow
d. Turbulent flow

Ans: a

24. When the fluid particles are in extreme state of disarray, their velocity fluctuations are
particularly violent and erratic then flow will be called as
a. Rotational flow
b. Un Steady flow
c. Turbulent flow
d. All the above

Ans: c

25. Which of the following represents unsteady uniform flow?
a. Flow through an expanding tube at an increasing rate
b. Flow through an expanding tube at an constant rate
c. Flow through long pipe in decreasing rate
d. Flow through long pipe in constant rate

Ans: c

**Basic Equations & Velocity Distribution**

1. The equation of continuity of flow is based on the principle of conservation of
a. Flow
b. Mass
c. Momentum
d. Energy

Ans: b
2. A one dimensional flow is one which
   a. Is uniform flow
   b. Is steady uniform flow
   c. Takes place in straight lines
   d. Involves zero transverse component of flow

   Ans: d

3. The equation of continuity holds good when the flow
   a. Is steady
   b. Is one dimensional
   c. Uniform velocity of flow in all cross sections
   d. All the above

   Ans: a

4. For a perfect incompressible liquid, flowing in a continuous stream, the total energy of a particle remains the same, while the particle moves from one point to another. This statement is called
   a. Continuity equation
   b. Bernoulli’s equation
   c. Pascal’s law
   d. Archimedes principle

   Ans: b

5. In a free vortex motion the radial component of velocity everywhere is
   a. Maximum
   b. Minimum
   c. Zero
   d. Unpredictable

   Ans: a
6. Bernoulli’s theorem deals with the principle of conservation of
   a. Energy
   b. Momentum
   c. Mass
   d. Force

   Ans: a

7. Bernoulli’s theorem has been derived under the assumption that no external force
   acts on the liquid except
   a. Atmospheric pressure
   b. Force due to gravity
   c. Wind pressure
   d. None of the above

   Ans: b

8. In general Bernoulli’s equation each of the terms represents
   a. Energy in kg.m/kg mass of fluid
   b. Energy in N.m/kg mass of fluid
   c. Energy in N.m/N weight of fluid
   d. Power in kW/kg mass of fluid

   Ans: c

9. Bernoulli’s equation is applicable between any two points
   a. In any rotational flow of an incompressible fluid
   b. In any type of irrotational flow of a fluid
   c. In steady rotational flow of an incompressible fluid
   d. In steady irrotational flow of an incompressible fluid

   Ans: d

10. The piezometric head of a flow is
    a. The sum of the velocity head and datum head
    b. The sum of the pressure head and datum head
    c. The sum of the pressure head and velocity head
    d. The sum of the velocity head and pressure head and datum head

    Ans: b
11. A 20cm diameter horizontal pipe is attached to a tank containing water. The water level in the tank is 7m above the pipe outlet and the pipe discharges into the atmosphere. Assuming a total loss of 3m in the pipe and kinetic energy correction factor $\alpha$ of the jet issuing from the pipe to be 1.20, the discharge in the pipe is $L/s$ is

a. 254 

b. 278 

c. 368 

d. 305

Ans: a

12. Water flows steadily down a vertical pipe of constant cross section. Neglecting friction, according to Bernoulli’s equation

a. Pressure is constant along the length of the pipe

b. Velocity decreases with height

c. Pressure decreases with height

b. Pressure decreases with height

Ans: c

13. A siphon used to empty a tank consists essentially of pipe with its summit 0.5m above the water surface of the tank and its outlet at 2.0 m below the summit. Neglecting friction and other losses, the velocity in the siphon is

a. 4.4m/s

b. 5.4m/s

c. 3.1m/s

d. 3.8m/s

Ans: b

14. The linear momentum equation is based on

a. Newton’s law of viscosity

b. Newton’s first law

c. Newton’s second law

d. Newton’s third law

Ans: c
15. A control volume is
   a. The volume of fluid flowing per unit of time
   b. A volume fixed in space
   c. The volume in which a control device is situated
   d. The volume of fluid controlling device
   Ans: b

16. The linear momentum equation is
   a. A scalar relation
   b. An approximate relation for engineering analysis
   c. A relation applicable to incompressible fluids only
   d. A vector relation
   Ans: d

17. In steady incompressible fluid flow with uniform velocity distribution, the momentum
   flux in a given x-direction past a given section is expressed as \( M_x = \)
   a. \( \rho QV \)
   b. \( \rho V^2/2 \)
   c. \( \rho QVx \)
   d. \( Q^2/A \)
   Ans: c

18. The velocity distribution over one half of a cross section is uniform and is zero over the
   remaining half. The momentum correction factor for this cross section is
   a. 2.0
   b. 4.0
   c. 1.0
   d. 3.0
   Ans: a
Specific Energy & Critical Flow

1. A rectangular channel has its width reduced from 6.0m to 4.0m at a transition. If the depth of flow upstream of the contraction is 1.2m, the change in the bottom elevation at the transition required to cause zero change in the water surface elevation is
   a. 0.6m drop
   b. 0.6m rise
   c. 0.30m drop
   d. 0.3m rise
   Ans: a

2. The term alternate depths in open channel flow is used to designate the depths
   a. At the beginning and end of a hydraulic jump
   b. Having same kinetic energy for a given discharge
   c. Having same specific energy for a given discharge
   d. At the beginning and end of a gradually varied flow profile
   Ans: c

3. Which of the following conditions is the chief characteristics of critical flow
   a. \( \frac{Q^2T}{gA^3} = 1 \)
   b. \( \frac{Q^2}{gA^2} = 1 \)
   c. \( \frac{Q^2R}{gA^3} = 1 \)
   d. \( \frac{Q^2T^2}{gA^3} = 1 \)
   Ans: a

4. If the alternate depths for certain flow in a rectangular channel are 0.5m and 3.0m respectively, the critical depth for this channel is
   a. 1.087m
   b. 1.333m
   c. 1.5m
   d. 3.5m
   Ans: a
5. While determining the critical depth applicable to channels of any shape, the length parameter used along with average velocity is the
   a. Ratio of area to wetted perimeter  
   b. Wetted perimeter  
   c. Depth of flow  
   d. Ratio of area to top width  
   Ans: d

6. In a rectangular channel if the critical depth is 2.0m, the specific energy at critical depth is
   a. 3.0m  
   b. 1.5m  
   c. 2.0m  
   d. 2.5m  
   Ans:

7. In a rectangular channel the depth of flow is 1.6m and the specific energy at that section is 2.7m The flow is
   a. Sub-critical  
   b. Supercritical  
   c. Critical  
   d. Not possible  
   Ans:

8. For uniform flow with a depth of 0.6m and Froude number of 2.0 in a rectangular channel, the specific energy will be
   a. 2.4m  
   b. 0.8m  
   c. 2.6m  
   d. 1.8m  
   Ans: d

9. A rectangular channel carries a uniform flow with a Froude number of 2.83. The ratio of critical depth to normal depth of this flow is
   a. 1.68  
   b. 2.83  
   c. 2.0  
   d. 4.75  
   Ans: c
10. In a triangular channel with side slopes of 2.0 horizontal vs 1 vertical, the critical depth is 2.8m. The specific energy at critical depth is
   a. 3.5m
   b. 3.0m
   c. 4.2m
   d. 3.72m
   Ans: a

11. For a given discharge in a channel at critical depth
   a. The total energy is minimum
   b. The total energy is maximum
   c. The specific energy is maximum
   d. The specific energy is minimum
   Ans: d

12. At critical depth
   a. The discharge is minimum for a given specific energy
   b. The discharge is maximum for a given specific force
   c. The discharge is minimum for a given specific force
   d. The discharge is maximum for a given specific energy
   Ans: d

13. The specific energy $E_c$ in a critical flow at a depth $Y_c$ occurring in a triangular channel is given by $E_c =$
   a. $1.25 Y_c$
   b. $1.5 Y_c$
   c. $1.75 Y_c$
   d. $2.5 Y_c$
   Ans: a

14. For a given discharge in a channel the critical depth is function of
   a. Slope of the channel
   b. Roughness of the channel
   c. Geometry of the channel
   d. Viscosity of the liquid
   Ans: c
15. If the Froude number characterizing the flow in an open channel is less than unity, an increase in the channel width at a transition causes the water surface elevation to
   a. Remain unchanged
   b. Decrease
   c. Increase
   d. Form ripples
   Ans: c

16. In a supercritical flow in a rectangular channel, a smooth expansion changes the width from B1 to B2. This causes the water surface elevation after the expansion to
   a. Increase
   b. Decrease
   c. Remain unchanged
   d. Increase or decrease depending upon the channel roughness
   Ans: b

17. For a given discharge in a horizontal frictionless channel two depths may have the same specific force. These two depths are known as
   a. Specific depths
   b. Sequent depths
   c. Alternate depths
   d. Normal or critical depths
   Ans: b

Flow measurements

1. The most economical section of a trapezoidal channel is one which has hydraulic mean depth equal to
   a. 0.5depth
   b. 0.5sloping side
   c. 0.5width
   d. 0.5(width + depth)
   Ans: a

2. If weir is used as a spillway it will have a crest
   a. Ogee shaped
   b. Broad and flat
   c. Narrow
   d. Cippolet
   Ans: a
3. In a tank or channel, notch is provided to measure
   a. Velocity
   b. Pressure
   c. Discharge
   d. Static energy
   Ans: c

4. Weir is also be used to measure
   a. Velocity of flow
   b. Pressure
   c. Discharge in a river or channel
   d. Kinetic energy
   Ans: c

5. The sheet of water flowing through a notch or over a weir is known as
   a. Nappe
   b. Crest
   c. Height of weir/ notch
   d. Sill
   Ans: a

6. For a suppressed rectangular weir an arrangement for aeration of nappe is necessary.
   a. To maintain water quality
   b. To prevent submergence of the weir
   c. To have the highest value of Cd
   d. To have a constant head discharge relationship which is independent of time
   Ans: d

7. In a triangular notch there is an error of 4% in observing the head. The error in the compound discharge is
   a. 4%
   b. 10%
   c. 6%
   d. 2.5%
   Ans: b
8. In a suppressed rectangular weir the computed discharge was found to be 3% in excess of the actual discharge. If this discrepancy was due to an error in reading the head, the measured head was
   a. 5% less
   b. 2% excess
   c. 2% less
   d. 1.5% excess
   Ans: b

9. In a 90° triangular notch, for a given head the error in the estimated discharge due to a 2% error in the measurement of the vertex angle is
   a. $\pi$ %
   b. 5.0%
   c. 3.0%
   d. $\pi/2$%
   Ans: a

10. A cippoletti weir discharges water with the head of water above the crest being 250mm. If the heat due to velocity of approach is 0.01m, what will be the excess percentage of discharge, as compared to when not so corrected?
    a. 3.5%
    b. 6%
    c. 3%
    d. 5.3%
    Ans: d

11. A cippoletti weir has a side slope of
    a. 1Vertical : 4 Horizontal
    b. 1Vertical : 2 Horizontal
    c. 1Horizontal : 4 Vertical
    d. 1Horizontal : 2 Vertical
    Ans: c

12. A submerged weir is one in which the water level on the downstream of the weir is
    a. Just at the crest level
    b. Below the crest level
    c. Is above the crest level
    d. At the same elevation as the upstream water surface
    Ans: c
Uniform Flow

1. Uniform flow in an open channel exists when the flow is steady and the
   a. Channel is frictionless
   b. Channel is non prismatic
   c. Channel is prismatic
   d. Channel is prismatic and the depth of flow is constant along the channel
      Ans: d

2. Uniform flow in an channel is characterized by the following statements
   a. Total energy remains constant along the channel
   b. Gradient of the total energy is parallel to the channel bed
   c. Specific energy decreases along the channel
   d. Total energy line either rises or falls depending upon the Froude number
      Ans: b

3. The flow can be uniform in
   a. A non prismatic channel
   b. A wide horizontal channel
   c. A wide rectangular channel
   d. A wide circular channel
      Ans:c

4. In wide rectangular channel the full supply depth is 1.52m. If 50% of the full supply
   discharge is flowing in this channel, the depth of flow will be
   a. 0.76
   b. 0.65
   c. 0.8
   d. 1
      Ans: d

5. A rectangular channel 3m wide is laid on a slope of 0.0002. The average boundary shear
   stress for depth of flow of 1.5m is nearly
   a. 0.5N/m2
   b. 0.75N/m2
   c. 0.15N/m2
   d. 0.9N/m2
      Ans: c
6. For hydraulically efficient rectangular channel of bed width 4.0m, the depth of flow is
   a. 2.0m
   b. 5.0m
   c. 6.0m
   d. 1.0m
   Ans: a

7. At the same mean velocity, the ratio of head loss per unit length for sewer pipe running full to that for the same pipe flowing half full would be
   a. 1.0m
   b. 2.0m
   c. 3.0m
   d. 0.65m
   Ans: a

Gradually Varied Flow

1. GVF is
   a. Steady uniform flow
   b. Steady non uniform flow
   c. Unsteady uniform flow
   d. Unsteady non uniform flow
   Ans: b

2. If $E= \text{Specific energy at a section in a gradually varied flow}$ then $dE/dx =$
   a. $S_0+S_f$
   b. $S_0-S_f$
   c. $S_f - S_0$
   d. $S_0/ S_f$
   Ans: b

3. If GVF $dy/dx$ is positive then $dE/dx$
   a. Is positive if $y/y_c > 1$
   b. Is positive if $y> y_c$
   c. Is negative if $y> y_c$
   d. Always negative
   Ans: a
4. A 3m wide rectangular channel flowing at its normal depth of 0.8m carries a discharge of 9.5m³/s. The channel slope is
a. Steep
b. Critical
c. Mild
d. Subcritical
Ans: a

5. In an M1 type GVF profile
a. \( Y_0 > y > y_c \)
b. \( y > Y_0 > y_c \)
c. \( Y_0 < y < y_c \)
d. \( y < Y_0 < y_c \)
Ans: b

6. In an M2 type GVF profile
a. \( Y_0 > y > y_c \)
b. \( y > Y_0 > y_c \)
c. \( Y_0 < y < y_c \)
d. \( y < Y_0 < y_c \)
Ans: a

7. The flow will be in supercritical state in the following profiles
a. M3, S3 and M1
b. M2, S1 and M3
c. S2, S3 and M3
d. S1, S2 and S3
Ans: c

**Hydraulic Jump**

1. The hydraulic jump occurs in a channel when
a. Depth of flow changes from sub critical to super critical
b. Depth of flow changes from super critical to sub critical
c. The flow occurs in an adverse channel
d. The flow occurs in a steep channel
2. The Froude number at the end of a hydraulic jump in a rectangular channel is 0.25. The sequent depth ratio of this jump is
   a. 2.5  
   b. 5.2  
   c. 8.9  
   d. 9.8  
   Ans: c

3. The sequent depth ratio of a hydraulic jump in a rectangular channel is 16.48. The Froude number at the beginning of the jump is
   a. 5.0  
   b. 4.0  
   c. 8.0  
   d. 12.0  
   Ans: d

4. The type of jump that forms when the initial Froude number lies between 2.5 and 4.5 is known as
   a. A oscillating jump  
   b. Weak jump  
   c. Steady jump  
   d. Undular jump  
   Ans: a

5. The sequent depths in a hydraulic jump formed in a horizontal rectangular channel are 0.2m and 2.0m. The length of the jump is about
   a. 50m  
   b. 25m  
   c. 8m  
   d. 12m  
   Ans: d

6. In a horizontal rectangular channel a hydraulic jump with a sequent depth ratio of 5.0 is formed. This jump can be classified as
   a. Steady jump  
   b. Strong jump  
   c. Weak jump  
   d. Normal jump  
   Ans: a
Unsteady Flow

1. A sluice gate controlling flow in a canal is suddenly lowered by an amount to cause partial closure. This will produce
   a. A negative wave on upstream
   b. A positive wave on the downstream
   c. A positive wave on the upstream
   d. A standing wave on the d/s
   Ans:

2. A rectangular channel of depth 1.2m and velocity 2.0m/s an elementary wave travelling u/s will have an absolute velocity of
   a. 5.43m/s
   b. 3.45m/s
   c. 2.53m/s
   d. 1.46m/s
   Ans: a

3. In a rectangular channel carrying a flow with a depth of 1.2m and velocity of 2.0m/s, a gate on the d/s is suddenly closed. If a positive surge of speed 3.75 m/s travelling u/s is produced, the height of the surge is
   a. 1.9m
   b. 2.5m
   c. 0.5m
   d. 0.8m
   Ans: d

4. If the bulk modulus of waterhammer wave velocity through a rigid pipe is
   a. 450m/s
   b. 996m/s
   c. 4396m/s
   d. 1401m/s
   Ans: d
5. A penstock is 3000m long. Pressure wave travels in it with a velocity of 1500m/s. If the gates of the turbine are closed uniformly and completely in 4s, then the closure is called
   a. Rapid
   b. Slow
   c. Sudden
   d. Very fast
   Ans: b

6. The function of surge tank is to
   a. Avoid reversal flow
   b. Reduce water hammer effect in a pipe line
   c. Smothen the flow
   d. None of the above
   Ans: b