

QUESTION AND ANSWERS

1. What do you mean by turbine?

The hydraulic machine which convert the hydraulic energy in to mechanical energy is called turbine

2. Define pump :

It is defined as the hydraulic machine which convert mechanical energy in to hydraulic energy

3. Define sub critical flow:

If the froude number is less than one then the flow is said to be sub critical flow

4. Define critical flow:

If the froude number is less equal to one it is called as critical flow.

5. Define supercritical flow:

If the froude number is greater than one it is called as super critical flow

6. What are the possible types of flow in open channel with respect to space and time?

A, steady and unsteady flow

B, uniform and nonuniform flow

7. what do you know about uniform and non uniform flow?

Uniform flow: If the given length of the channel ,depth ,velocity ,the rate of flow, cross section are constant.

Non Uniform flow: If the given length of the channel ,depth ,velocity ,the rate of flow, cross section are not constant.

8. Define specific energy:

It is defined as energy per unit weight of the liquid with respect to the bottom of the channel.

9. What is meant by wetted perimeter?

The wetted perimeter ( $p$ ) is the length of the line of intersection of the channel wetted

The velocity of flow at the critical depth is known as critical velocity.

12. Define the term most economical section of the channel:

A section of the channel is said to be most economical when the cost of construction of the channel is minimum. But the cost of construction depends up on the excavation and lining to keep the cost minimum. The wetted perimeter for a given discharge should be minimum.

13. Define gradually varying flow

If the change in depth in a varying flow is gradual so that the curvature of the streaming line is not excessive such flow is called gradually varying flow.

14. Define Rapidly varying flow

If the curvature in a varied flow is large and depth changes appreciably over short length it is called rapidly varying flow.

15. Define afflux

The maximum increase in water level due to obstruction in the path of flow is known as afflux.

15. Define length of backwater curve

The distance along the bed of the channel between the section where water starts raising to the section where water is having maximum height is known as the length of the back water curve

16. Define back water

The profile of the raising water on the upstream side of the dam is called as back water curve.

17. Define hydraulic jump

The raise of water level which takes place due to the transformation of the unstable shooting flow (super critical flow) to the stable Streaming flow (sub critical flow) is called hydraulic jump.

18. Define cavitations

cavitations is defined as phenomenon of formation of vapour bubbles in a region of a flowing liquid where the pressure in the liquid is falls below than vapour pressure and sudden collapsing of these vapour bubbles in a region of higher pressure.

19. What is known by governing of a turbine?

### 21. Explain net head

It is defined as the head available at the inlet of turbine. If  $H_f$  is the loss due to friction between water and penstock then net head

$$H = H_g - H_f$$

### 22. Define Hydraulic Efficiency:

It is defined as the ratio of power delivered to the runner to the power supplied at the inlet.

### 23. Define mechanical efficiency

It is defined as the ratio of power at the shaft of the turbine to the power delivered by the water to runner.

### 24. Define volumetric efficiency

It is defined as the ratio of volume of water actually striking the runner to the Volume of water supplied to the runner.

### 25. Define over all efficiency

It is defined as the ratio of shaft power by water power

### 26. Explain impulse turbine

If at the inlet of the turbine the energy available is only kinetic energy the turbine is known as impulse turbine.

### 27. Explain Reaction turbine

if at the inlet of the turbine the water possesses kinetic energy as well as pressure energy the turbine is known as reaction turbine.

### 28. Explain tangential flow turbine

If the water flows along the tangent of the runner, the turbine is known as the tangential flow turbine.

### 29. Explain radial flow turbine

If the water flows in the radial direction through the runner the turbine is called radial flow turbine.

### 30. Explain inward flow radial turbine

If the water flows from outwards to inwards radially the turbine is called inward radial

31.Explain outward flow radial turbine

If the water flows radially from inwards to outwards the turbine is known as outward radial flow turbine.

32.Define axial flow turbine

If the water flows through the runner along the direction parallel to the axis of rotation of the runner the turbine is called axial flow turbine.

33.what is Pelton wheel:

Pelton wheel or Pelton turbine is a tangential flow impulse turbine. The water strikes the bucket along the tangent of the runner . The energy available at the inlet of the Turbine is only kinetic energy.This turbine is used for high heads.

34.What is breaking jet?

When the nozzle is completely closed ,the amount of water striking the runner reduces to zero but the runner due to inertia goes on revolving for a long time to stop the runner in a short time a small nozzle is provided which direct the jet of water on the back of vanes .This jet of water is called breaking jet.

35.What is jet ratio?

It is the ratio of pitch diameter (D) to the diameter of jet (d).

36.What is Draft tube?

A tube or pipe of gradually increasing area is used for discharging water from the exit of the turbine to the tail race is called draft tube.

37.Define Degree of Reaction (R)

It is defined as the ratio of change of pressure energy inside the runner to the change of total energy outside the runner.

38.what is radial discharge?

This means the angle made by absolute velocity with the tangent on the wheel is 90 and the component of whirl velocity is zero.

39.Define Francis turbine:

Inward flow reaction turbine having radial discharge at outlet is known as Francis

40. Define propeller turbine:

This is an example of axial flow reaction turbine. Here the vanes are fixed to the hub and are not adjustable.

41. Define Kaplan turbine:

This is an example of axial flow reaction turbine. Here the vanes are not fixed to the hub and are adjustable.

42. What are the use of draft tube?

1. the net head on the turbine increases.
2. due to increase in net head the power and efficiency of the turbine also increases.
3. the large amount of rejected kinetic energy is converted in to usefull pressure energy

43. What are types of draft tube?

1. conical draft tube
2. simple elbow tube
3. moody spreading tube
3. draft tube with circular inlet and rectangular outlet.

44. What are the types of characteristic curves

1. Main characteristic curves 2. Operating characteristic curve 3. Muschel characteristic curves

45. What is specific speed of the turbine?

It is defined as the speed of a turbine which will develop unit power under unit head.

46. Define unit quantities;

Unit quantities are the quantities which are obtained when the head on the turbine are unity.

47. Explain about characteristic curves of a hydraulic turbine

Characteristic curves of a hydraulic turbine are the curves with the help of which the exact behaviour and performance of the turbine under

different working conditions can be known.

A section of the channel is said to be most economical when the cost of construction of the channel is minimum. But the cost of construction mainly depend up on the excavation and lining to keep the cost minimum ,the wetted perimeter for a given discharge should be minimum.

50. What are the conditions of rectangular channel of best section?

The two conditions are breadth is equal to two times the depth ( $b=2d$ ) and hydraulic mean depth is equal to half the depth ( $m=d/2$ ) 51. Write down the conditions for the most economical trapezoidal channel?

1. Half the top width is equal to one of sloping side  $(b+2nd)/2=d(1+n^2)$
2. Hydraulic mean depth is equal to half the depth.

52. Write down the conditions of most economical circular channel with maximum velocity?

$$=128^\circ 45'$$

$$d=0.81D$$

$$m=0.3D$$

53. What do you mean by open channel flow?

1. Open channel flow has a free surface which is subjected to atmospheric pressure.
2. In open channel flow the cross section is irregular.

54. What do you mean by pipe flow?

1. Pipe flow has no free surface and subjected to hydraulic pressure only.
2. The cross section of the flow is fixed

55. List the instrument used to measure open channel flow

1. pitot tube
2. ultrasonic flow instrument.
3. Dropper instrument
4. Gurley instrument.

56. What is the best side slope for trapezoidal channel ?

=60° is the best side slope for trapezoidal channel.

57. what do mean by M<sub>1</sub> profile?

The most common of all gradually varying flow is of M<sub>1</sub> type which is a sub critical flow condition obstructions to flow such as wiers, dams etc... which produce M<sub>1</sub> profile.

58. What are the types of flow profile?

Mild slope profile  
 Steep slope profile  
 Critical slope profile  
 Horizontal bed profile  
 Adverse slope profile

59. What do you mean by M<sub>2</sub> profile?

The M<sub>2</sub> profile occurs at a sudden drop in the bed of the channel in to the ponds or pools or lakes.

60. What do mean by M<sub>3</sub> profile?

The M<sub>3</sub> profile occurs the flow yielding from a spillway or a sluice gate.

61. What is speed ratio?

$$U_1 = (2gH)$$

Where U<sub>1</sub> – tangential velocity of wheel at inlet

-speed ratio

H – Head of the turbine.

62. What do you mean by coefficient of velocity?

$$V_1 = C_v (2gH)$$

V<sub>1</sub> = velocity of jet

C<sub>v</sub> = coefficient of velocity

H = head of the turbine.

63. What are the main parts of pelton wheel turbine?

regulating arrangement

3. casing

4. breaking jet

64. What are the main mechanisms of Radial flow reaction turbine?

1. casing

2. guide mechanism

3. runner

4. draft tube

65. Define Multistage pump:

If a centrifugal pump consists of two or more impellers, the pump is called a multistage pump. To produce a high head, impellers are connected in series. To produce high discharge, impellers are connected in parallel.

66. Define Manometric head:

Manometric head is the head against which a centrifugal pump has to work.

$$H_m = H_s + h_d + H_{fs} + H_{fd} + (v_d^2/2g)$$

Where  $H_m$  – manometric head

$H_s$  - suction head

$H_d$  – delivery head

$H_{fs}$  – friction head loss in suction pipe

$H_{fd}$  – friction head loss in delivery pipe

67. What is Net Positive Suction Head (NPSH) ?

NPSH is defined as the total head required to make liquid flow through suction pipe to pipe impeller.

68. Define slip of a reciprocating pump and negative slip:

Slip is defined as the difference between theoretical discharge and actual discharge.

If actual discharge is greater than theoretical discharge, a negative value is found. This negative value is called negative slip.

69. What do you know coefficient of discharge?

It is defined as the ratio of actual discharge by theoretical discharge. It is denoted by  $C_d$ .

70. What do you know Drop down curve?



71. What is separation of reciprocating pump?

If the pressure in the cylinder is below the vapour pressure, dissolved gases will be liberated from the liquid and cavitations will take place. The continuous flow of liquid will not exit which means separation of liquid takes place. The pressure at which separation takes place is called separation pressure and head corresponding to the separation pressure is called separation pressure head.

72. What is an indicator diagram?

Indicator diagram is the graph between the pressure head and distance traveled by the piston from inner dead center for one complete revolution.

73. What is Air vessel?

Air vessel is a closed chamber containing compressed air in the top portion and liquid at the bottom of the chamber. It is used to obtain a continuous supply of water at uniform rate to save a considerable amount of work and to run the pump at high speed without separation.

74. What are the assumptions of gradually varying flow profile?

1. Pressure distribution at any section is assumed to be hydrostatic.
2. The velocity distribution at the channel section is fixed
3. The channel is prismatic
4. The roughness coefficient is independent of the depth of flow.

75. What are the two cases where distance of the normal depth of flow does not exist?

- (a) When the channel bed is horizontal
- (b) When the channel bed has an adverse slope.

76. What are the methods used for finding gradually varying flow profile?

1. Direct integration method
2. Numerical method
3. Graphical representation method.

77. What are the classifications of hydraulic turbine according to the type of energy at inlet?

- (a) Impulse turbine and
- (b) Reaction turbine

78. What are the types of turbine according to direction of flow through runner?

- (a) Tangential flow turbine
- (b) Radial flow turbine

- (d) Mixed flow turbine

79. What are the types of turbine according to the head at the inlet of the turbine?

- (a) high head turbine
- (b) medium head turbine
- (c) low head turbine

80. What are the types of turbine according to the specific speed of the turbine?

- (a) Low specific speed turbine
- (b) Medium specific speed turbine
- (c) High specific speed turbine.

81. Write down the expression for energy loss due to hydraulic jump?

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$$H_L = (d_2 - d_1)^3 / (4d_1d_2)$$

Where

$H_L$  – energy loss due to hydraulic jump

$D_2$  - depth of flow after the jump

$D_1$  -- depth of flow before the jump

82. What do you mean by length of hydraulic jump?

This is defined as the length between the two sections where one section is taken before the hydraulic jump and the second section is taken immediately after the jump.

83. What are the classification of flow in channels?

1. steady flow and un steady flow.
2. uniform flow and non uniform flow.
3. Laminar flow and turbulent flow and
4. sub critical , critical and super critical flow.

84. What are the types of Non uniform flow?

- (i) Rapidly Varied Flow (R.V.F)
- (ii) Gradually Varied Flow (G.V.F)

85. What do you know about laminar and turbulent flow?

Laminar flow: The flow in open channel is said to be laminar if the Reynolds number(  $R_e$ ) is less than 500

Turbulent flow: If the Reynolds number is greater than 2000 it is called turbulent flow.

86. What do you mean by specific energy curve?

It is defined as the curve which shows the variation of specific energy with respect to depth of flow.

87. Write the manometric efficiency of the pump?

$$\text{Manometric efficiency} = (gH_m) / (V_w 2U_2)$$

Where

$H_m$  – manometric head

88. Write the expression for over all efficiency ? over all efficiency

$$= (\rho g Q H_m) / (1000 \times P) \text{ Where}$$

$H_m$  – manometric head

the minimum speed for starting the centrifugal pump?

PREPARED BY STUCOR 89. What is

$$N = \frac{120 \eta_{man} V_{w2} D}{(D_2^2 - D_1^2)} \text{ Where}$$

$\eta_{man}$  – manometric efficiency

$V_{w2}$  – Whirl at out let of the turbine

$D_2$  – diameter of impeller at out let

90. Write down the use of centrifugal pump?

1. Used in deep sump and basement
2. The high discharge capacity
3. It is driven by electric motors

91. Define open channel flow?

The term *open channel flow* denotes the gravity-driven flow of a liquid with a free surface.

92. What do you mean by stream lining?

Streamlining is adding a faired tail section to reduce the extent of separated flow on the downstream portion of an object.

93. What is centrifugal pump?

The hydraulic machines which convert mechanical energy into pressure energy by means of centrifugal force is called centrifugal pump. It acts a reverse of inward radial flow turbine.

94. What do you know about Hub or Boss?

It is the core part of the axial flow turbine where the vanes are attached.

95. Under what head the propeller turbine take water?

About 100 m head the propeller turbine take water.

When the vanes are fixed to the hub and they are not adjustable the turbine is called propeller turbine.

96. What are the uses of Kaplan turbine?

1. To produce more output.
2. The efficiency of the turbine is more

97. Define unit speed:

It is defined as the speed of the turbine under unit head

$$N_u = N/H$$

$N_u$  –unit speed

$N$  –number of rotations

$H$ - head of the turbine

98. Define unit discharge

It is defined as the discharge passing through the turbine which is working under unit head.

$$Q_u = Q/H$$

Where

$Q_u$  – unit discharge

$Q$  – Total discharge

$H$ - head of the turbine

99. Define unit power:

It is defined as the power developed by the turbine working under unit head.

$$P_u = P/H^{3/2}$$

Where  $P_u$  - unit power.

$P$  - Total power.

$H$ - head of the turbine.

100. What are the main parts of centrifugal pump?

1. Suction pipe with foot valve and strainer
2. Impeller
3. casing
4. delivery pipe

101. What are fluid machines?

The machines which use the liquid or gas for the transfer of energy from fluid to rotor or from rotor to fluid, are known as fluid machines.

102. What are hydraulic machines and thermal turbo machines?

If liquid is used for the transfer of energy, then machines are known as hydraulic machines whereas if gas is used then machines are known as thermal turbo machines.

103. How are fluid machines classified?

transfer of energy :

1. Turbines

2. Pumps or compressors..

104. What is the purpose of an air vessel fitted in the pump?

1. To obtain a continuous supply of liquid at a uniform rate.
2. To save a considerable amount of work in overcoming the frictional resistance in the suction and delivery pipes, and
3. To run the pump at a high speed with out separation.

105. What is the work saved by fitting a air vessel in a single acting ,double acting pump?

Work saved by fitting air vessels in a single acting pump is 84.87%,  
In a double acting pump the work saved is 39.2%.

106. What is Discharge through a Reciprocating Pump in Per sec ?

For Single acting

$$\text{Discharge (Q)} = \frac{ALN}{60}$$

Where

A=Area of the Cylinder in  $\text{m}^2$   
L=Length of Stroke in m. N=Speed  
of Crank in RPM

For Double acting

$$Q = \frac{2ALN}{60}$$

107. What is the Workdone by Reciprocating Pump Per sec.?

$$\text{Workdone} = \frac{gALN(h_s + h_d)}{60} \text{ (for single acting)}$$

For Double acting:

$$\text{Work done} = \frac{2 gALN(h_s + h_d)}{60}$$

Where

=Density of Water in  $\text{kg/m}^3$   
A=Area of the Cylinder in  $\text{m}^2$   
L=Length of Stroke in m  
N=Speed in rpm  
 $h_s, h_d$ =Suction and Delivery head in m

f = Co-efficient of friction.    A = Area of piston in  $m^2$ .    a = Area of pipe in  $m^2$ .  
where  
= Angular speed                      r = Radius of crank

109. What is the relation between Work done of a Pump and Area of Indicator Diagram ?

Work done by the pump is Proportional to the area of the Indicator diagram.

110.. What is the Work done by the Pump per sec due to acceleration and friction in the suction and delivery Pipes ?

For single acting

$$W = gALN(h_s + h_d + 0.67h_{fs} + 0.67h_{fd})/60$$

For Double acting

$$W = 2 gALN(h_s + h_d + 0.67h_{fs} + 0.67h_{fd})/60$$

Where  $h_{fs}$ ,  $h_{fd}$  = loss of head due to acceleration in the suction and delivery Pipe.

111.. What is the Mean Velocity of Single acting reciprocating pump ?

$$v = A \omega / 3.14a$$

Where

$\omega$  = Angular velocity in rad/sec    r = Radius of the crank in m

A and a = Area of cylinder and Pipe in  $m^2$

mp and rotating cylinder pump.