University of Mumbai

Civil Engineering Examination

Sub: CE-C503/ Applied Hydraulics **Year/Sem:- TE/ V Sem**
Max. Marks: 80 **Duration: - 2Hrs**

Q1. Attempt all the MCQS **(20 X 2 mark= 40 marks)**

1. The maximum discharge through a circular channel takes place when the depth of flow is equal to
   a) 0.3 times the diameter.
   b) 0.81 times the diameter.
   c) 0.95 times the diameter.
   d) 0.65 times the diameter.

2. The maximum velocity through a circular channel takes place when the depth of flow is equal to
   a) 0.3 times the diameter.
   b) 0.81 times the diameter.
   c) 0.95 times the diameter.
   d) 0.65 times the diameter.

3. A most economical section is one which for a given cross-sectional area, slope of the bed (i) and co-efficient of resistance has:
   a) Maximum wetted perimeter.
   b) Maximum discharge.
   c) Maximum depth of flow.
   d) Maximum velocity of flow.

4. If the Froude's Number in an open channel flow is more than 1, the flow is called as
   a) Critical flow.
   b) Streaming flow.
   c) Shooting flow.
   d) Stable flow.

5. Specific speed of the turbine is defined as the speed of the turbine which
   a) Produces unit power working under unit head.
   b) Produce unit horse-power at unit discharge.
   c) Delivers unit discharge at unit head.
   d) Delivers unit discharge at unit power.

6. For dimensional analysis resolving any phenomenon in Fluid Mechanics in consideration of heat, the fundamental quantities are:
   a) Length, Mass, Time.
   b) Length, Mass, Time, Temperature.
   c) Length, Volume, Time, Climate.
   d) Distance, Mass, Time, Temperature

7. The dimension for kinematic viscosity is:
   a) L ^-2 T ^ -1.

b) L ^ 3 T ^ 1
c) L ^2 T ^ -2
d) L ^2 T ^ -1

8. Secondary or Derived quantities are:
   a) Those quantities which possess at least one fundamental dimension
   b) Those quantities which possess minimum four fundamental dimensions.
   c) Those quantities which possess more than one fundamental dimensions.
   d) Those quantities which possess maximum three fundamental dimensions.

9. The force exerted on a stationary inclined plate in the direction normal to the plate is given by
   a) q A V ^ 2 sin theta.
   b) q A V ^ 2 sin ^ 2 theta.
   c) q A V ^ 2 sin theta cos theta.
   d) - q A V ^ 2 sin theta

10. Impulse momentum equation states that,
   a) The resulting torque acting on a rotating fluid is equal to the rate of change of moment of momentum.
   b) The impulse of a Force acting on a fluid mass m in a short interval of time is equal to the change in momentum in the direction of force.
   c) The impulse of a Force acting on a fluid mass m in a short interval of time is equal to the change in momentum in the opposite direction of force.
   d) The net force acting on a fluid mass is equal to the change in momentum of flow per unit time in opposite direction.

11. One of the disadvantages of resolving the dimensions of a physical phenomenon by Rayleigh's method is that if the number of _____ variables becomes more than _____ then it is very difficult to find the expression for the _____ variable
   a) Dependent, three, independent.
   b) Dependent, four, independent.
   c) Independent, three, dependent.
   d) Independent, four, dependent.

12. The condition for maximum efficiency for a ship when inlet orifice are at right angle to the direction of motion of ship is
   a) Velocity of the ship is equal to relative velocity of jet w.r.t ship.
   b) Absolute velocity of jet of water coming out at back of ship is equal to the relative velocity of jet w.r.t. ship.
   c) Absolute velocity of jet of water coming out at back of ship is equal to the velocity of the ship.
   d) Relative velocity of the jet w.r.t. ship is equal to velocity of the ship.

13. For a series of radial curved vanes, the tangential velocities are not equal because
   a) The radius at inlet and outlet is different.
   b) The jet enters the vane with shock.
   c) The jet enters without shock.
   d) The jet hits the blade tangentially.

14. Hydraulic efficiency of a turbine is defined as:

a) Ratio of power given by the water to the runner of the turbine to the power supplied by the water at the inlet of the turbine.
b) Ratio of volume of water actually striking the runner to the volume of water supplied to the turbine.
c) Ratio of power available at the shaft of the turbine to the power supplied by the water at the inlet of the turbine.
d) Ratio of power available at the shaft of the turbine to the power delivered to the runner.

15. Pelton Wheel Turbine is _____ Turbine, with _____flow used for _____ heads.
a) Impulse, Radial, Medium.
b) Impulse, Tangential, High.
c) Reaction, Axial, Medium.
d) Reaction, Mixed, Low.

16. The efficiency of a Pelton Wheel turbine will be maximum when:
a) Velocity of the wheel is half the velocity of jet of water at inlet.
b) Velocity of jet of water at inlet is half the velocity of the wheel.
c) Component of velocity in the direction of jet is twice the velocity of the wheel.
d) Velocity of wheel is equal to the component of velocity in the direction of jet.

17. Cavitation will take place if the pressure of the flowing fluid at any point is:
a) More than vapour pressure of the fluid.
b) Equal to vapour pressure of the fluid.
c) Is less than vapour pressure of the fluid.
d) More than vapour pressure of the fluid.

18. Specific speed of pumps is:
a) Head developed is unity and discharge is one cubic metre.
b) Head developed is unity and the shaft horse-power is also unity.
c) Discharge is one cubic-metre and shaft horse-power is unity.
d) Discharge is unity and shaft horse-power is also unity.

19. The default value of angle of deflection for a Pelton wheel turbine if not provided is:
a) 155.
b) 160.
c) 165.
d) 170.

20. To produce a high head by multistage centrifugal pump, the impellers are connected in:
a) Parallel
b) Series.
c) Combined seires and parallel.
d) Alternate series and parallel.

Q2. Attempt any FOUR **(04 X 05 marks= 20 marks)**

1. A pipe of 300mm diameter conveying 0.3m^3/sec of water has a right-angled bend in a horizontal plane. Find the resultant forces exerted on the bend if the pressure at inlet and outlet of the bend are 24.5 N/cm^2 and 23.5 N/cm^2 respectively.

2. A turbine is operating under a head of 25m at 200RPM the discharge is 9 cumec. If the efficiency is 90%. determine the performance of turbine under a head of 20m.

3. An oil of specific gravity 0.9 and viscosity 0.9 Poise is to be transported at the rate of 1000litres/sec through a 1.2m diameter pipe. Tests are to be conducted on a 10cm diameter pipe using water at 20ºC. Viscosity of water at 20ºC is 0.01 Poise. Find the rate of flow in the model.

4. What is multi-stage centrifugal pump? State in which conditions they are applicable.

5. Derive expression for most economical trapezoidal section.

6. Derive expression for force exerted by jet of water on fixed inclined plate.

Q3. Attempt any TWO **(02 X 10 marks= 20 marks)**

1. A conical draft tube having diameter at the top as 2m and pressure head of 7m of water (vaccum) discharge water at the outlet with a velocity of 1.2m/sec at the rate of 25m^3/sec. If atmospheric pressure head is 10.3m of water and losses B/W the inlet and outlet of the draft tube are negligible, find the length of draft tube immersed in water. Total length of tube is 5m.

2. The pressure drop Δp in a pipe of diameter D and length L depends on mass density ρ and viscosity μ of the flowing fluid, mean velocity of flow V and the average height k of roughness projections on the pipe surface.

3. A three-stage centrifugal pump has impeller 400mm in diameter and 20mm wide. The vane angle at outlet is 45º and the area occupied by the thickness of the vanes may be assumed 8% of the total area. If the pump delivers 3.6$m^3$of water per minute when running at 920rpm. Determine: i] Power of the pump. ii] Manometric head. iii] Specific speed.
   Mechanical efficiency: 88%, Manometric efficiency: 77%.

4. Determine the length of the back-water curve caused by an afflux of 2m in rectangular channel of width 40m and depth 2.5m. The slope of the bed is given as 1 in 11000. Manning's N= 0.03.