Aldel Education Trust's
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NAAC Accredited with Grade 'A' (2017-2022)
Department of Civil Engineering

Sample Question Paper for Applied Hydraulics

Q1. Solve all questions mandatory **02 marks each**

Q1. a A jet of water of 40mm diameter strikes horizontally at the centre of a square plate of uniform thickness and having a mass of 16 kg and edge height 25 cm with 10 m/sec. The square plate is suspended vertically by a hinge on its top horizontal edge. What is the force to be applied at the lower edge of the plate to keep it vertical?

I. 15.65 N
II. 62.83 N
III. 78.48 N
IV. 71.24 N

Q1.b The flow in which each liquid particle has a definite path and their paths do not cross each other is called

I. One dimensional flow
II. Streamline flow
III. Steady flow
IV. Turbulent flow

Q1. c A 2.2 m diameter pipe is supposed to transport oil at the rate of 2750 litre/s. To analyse the project, a model pipe was decided to use for testing with a diameter of 18 cm using water at 20 C. What will be the rate of flow of the model? (oil: Density - 910 kg/m3 ; viscosity - 3x10-2 poise) (water : viscosity - 1x10-2 poise)

I. 0.723 m/s
II. 1.93 m/s
III. 2.68 m/s
IV. 0.88 m/s

Q1. d What does Kinematic viscosity depend upon?

I. Pressure
II. Fluid flow
III. Density
IV. Fluid level

Q1. e For a fully-developed pipe flow, how does the velocity vary with the length of the pipe?

I. Linearly

II. Parabolic

III. Exponential

IV. Constant

Q1. f Critical depth (h) of a channel, is

I. h = (v)2/g

II. h = (v)2/2g

III. h = v/2g

IV. h = v/g

Q1. g The ratio of the inertia and gravitational force acting in any flow, ignoring other forces, is called

I. Euler number

II. Frode number

III. Reynold number

IV. Weber number

Q1. h Dimensions of the dynamic viscosity (μ) are

I. MLT-2

II. M-1L-1T-1

III. ML-1T-2

IV. ML-1T-1

Q1. i If velocities of fluid particles vary from point to point in magnitude and direction, as well as from instant to instant, the flow is said to be

I. laminar

II. turbulent flow

III. uniform flow

IV. non-uniform flow.

Q1. j The best side slope for most economical trapezoidal section, is

I. 30°

II. 45°

III. 60°

IV. None of these.

Q1. k For a most economical rectangular channel, the width of the channel must be

I. equal to depth of flow

II. twice the depth of flow

III. half the depth of flow

IV. None of these

Q1. l The flow in open channel is laminar if the Reynold number is

I. less than 500
II. more than 500
III. 1000
IV. none of these.

Q1. m A 300 mm diameter pipe carries water under a head of 25 meters with a velocity of 4.7 m/s. If the axis of pipe turns through 45 degrees, what will be the force in X-direction?

I. 5087.6
II. 4619.8
III. 5534.4
IV. 6288.7

Q1. n A lawn sprinkler has 1.1 cm diameter nozzle at the end of a rotating arm and discharges water at the rate of 13 m/s. How much is the torque required to hold the rotating arm stationary? (in Nm)

I. 0.4751
II. 4.2763
III. 2.3757
IV. 1.9006

Q1. o Which principle is used in Hydraulic Turbines?

I. Faraday law
II. Newton's second law
III. Charles law
IV. Braggs law

Q1. p The specific speed of a turbine is

I. N√P / H^1/4
II. N√P / H^3/4
III. N√P / H^5/4
IV. N√P / H^7/4

Q1. q The runner of the Francis turbine has an outer diameter 500mm and the inner diameter 350mm. It works under a head of 60m. The width at the inlet is 75mm. The angle of the blades at the inlet and outlet are 93˚ and 30˚ respectively. The flow enters the vanes at an angle of 23˚. Mechanical losses are 6% and the area taken by the vanes is 7% of the total area, hydraulic efficiency is 90% and the flow velocity is constant. Find the speed of the runner so that entry of water into runner is shock less. Find power produced by the turbine.

I. P = 613.13KW, N = 1023 rpm

II. P = 571.93KW, N = 923 rpm

III. P = 526.23KW, N = 888 rpm

IV. P = 496.73KW, N = 813 rpm

Q1. r In inward flow reaction turbine running at 500 rpm has an externaldiameter is 700 mm and a width of 180 mm. If the guide vanes are at 20ºto the wheel tangent and the absolute velocity of water at inlet is 25 m/s,find (a) discharge through the turbine (b) inlet vane angle

I. 3.384 m3/s ; 58.89º

II. 3.65 m3/s ; 56.33º

III. 3.21 m3/s ; 51.47º

IV. 2.94m3/s ; 49.88º

Q1. s The fluid coming into the centrifugal pump is accelerated by _____

I. Throttle

II. Impeller

III. Nozzle

IV. Governor

Q1. t Degree of reaction turbine is the ratio of?

I. Pressure energy to total energy

II. Kinetic energy to total energy

III. Potential energy to total energy

IV. Kinetic energy to potential energy

Q2 Solve any four **05 marks each**

Q2.a Derive condition for most economical circular section for maximum velocity.

Q2.b Derive the expression for torque in a rotating arm with the help of suitable diagram using moment of momentum principle.

Q2.c Explain term hydraulic jump. Drive an expression for the depth of hydraulic jump in term of the upstream Froude number.

Q2.d Show that the angle of swing of vertical hinged plate is given by $\sin\theta = \rho aWV_2$

Q2.e Explain the working of Hydro power plant

Q3 Solve any four **05 marks each**

Q3.a A jet of water of diameter 7.5 cm strikes a curved plate at its center with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of the jet. The jet is deflected through an angle of 165 degree. Assuming The plate smooth find force exerted on the plate in direction of the jet , power of the jet and efficiency of the jet.

Q3.b A rectangular channel 4.6 m wide has depth of water 1.8 m. The slope of bed of the channel is 2 in

2500 and value of Chezy's constant C = 55. It is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross section, slope of the bed and roughness of the channel. Find the new dimensions of the channel and increase in discharge.

Q3.c A pipe of 300 mm diameter conveying 0.30 m3 /s of water has a right angles, bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 24.525 N /cm2 and 23.544 N/cm2.

Q3.d The internal and external diameters of an outward flow reaction turbine are 1.8 m and 2.6 m respectively. The turbine is running at 345 r.p.m. and rate of flow of water through the turbine is 4.8 m3/s. The width of the runner is constant at inlet and outlet and is equal to 300 mm. The head on the turbine is 170 m. Neglecting thickness of the vanes and taking discharge radial at outlet determine: (i) Vane angles at inlet and outlet, and (ii) Velocity of flow at inlet and outlet.

Q3.e A centrifugal pump has following dimensions: inlet radius = 90 mm ; outlet radius = 170 mm ; width of impeller at the inlet = 50 mm; $\beta_1 = 0.4$ radians ; $\beta_2 = 0.25$ radians ; width of impeller at outlet = 60 mm. Determine discharge and head developed by the pump when the impeller rotates at 100 radians/seconds.