b) A 2mm dia. spherical metallic ball (sp. weight 117.50 kN/m^3) is dropped in a large mass of fluid of viscosity 15 poise and Specific gravity 0.95 proceeding from first principle make calculation for the drag force exerted by fluid on metallic ball, pressure drag, 5km drag and terminal velocity of ball in fluid. 10

a) State the advantages and disadvantages of a Francis turbine over a Pelton wheel. 3

b) What is draft tube? Explain the different types of draft tube? 4

c) The following data pertaining to a kaplan turbine; power available at shaft = 22500 kW, Head = 25m speed = 150rpm, Hydraulic efficiency = 95% overall efficiency = 88% outer dia. of runner = 5.0m, Hub diameter = 2.0m. Assuming that the turbine discharges without whirls at exit determine the runner vane angles of the hub and at the outer periphery. 7

OR

a) Explain briefly with neat sketches any two of the following:

i) Volute casing

ii) Vortex casing

iii) Casing with guide blades 7

b) Define specific speed of a centrifugal pump. Derive an expression for the same. 7

Roll No .....

CE - 503

B.E. V Semester

Examination, December 2013

Fluid Mechanics - II

Time : Three Hours

Maximum Marks : 70

Note: Attempt all the five questions. There is internal choice in each question. Assume suitable data if required.

1. a) Explain the various laws assumed for velocity distribution in laminar boundary layer. 4

b) A flat plate of 2.0m width and 4.0m length is kept parallel to air flowing at 6.0m/s velocity at 15°C. Determine the length of plate over which the boundary layer is laminar, shear at the location where boundary layer ceases to be laminar and total force on both sides on that portion of plate where the boundary layer is laminar. Take P=1.208 Kg/m^3 and V=1.47×10^{-5}m^2/sec. 10

OR

a) Obtain the condition for maximum transmission of power in a pipeline. What is the efficiency for this condition? 4

b) Two reservoirs having a difference in elevation of 15m are connected by a 200mm diameter of siphon. The length of the system is 500m and the summit is 3.5m above the water level in upper reservoir. The length of the pipe from

upper reservoir to the summit is 120m. If the co-efficient

i) discharge through siphon

ii) Pressure at the summit. Neglect minor losses. 10

2. a) For a trapezoidal channel of most economical sec. Prove that: 7

i) Half the top width = length of side slope

ii) Hydraulic mean depth = 1/2 depth of flow

b) Water flows at a steady and uniform depth of 2.0m in a rectangular channel having bed width 6m and laid at a slope of 1:1000. It is desired to obtain critical flow in the channel by providing a hump in the bed. Calculate the height of hump. Take manning's goering co-efficient N = 0.02 7

OR

a) What is circuit flow? Show that critical flow occurs in an open channel when Froude No. is unity and when the depth of flow is two thirds of specific energy. 7

b) A trapezoidal channel with side slopes of 1:1 has to be designed to convey $12m^3$/sec at a velocity of 2m/sec so that the amount of concrete lining for bed and side slopes in minimum: 7

i) Calculate the area of lining per meter length of canal.

ii) Calculate the bed slope of Canal if N= 0.015

3. a) Define gradually varied flow and rapid varied flow. Also give the assumption made in gradually varied flow. 4

b) Water is flowing in a rectangular channel of bed width 10m and depth of water 1m. The bed slope of the channel is 1 : 2500 and this is constant for at least 3km upstream. Taking Chezy's constant = 60, Calculate the steady flow in the channel. If a wall is placed across the channel increasing the depth of the wall to 2.0m, determine the depth of flow at 500m upstream of wall. 10

OR

a) What do you mean by a hydraulic jump? Obtain an expression for the depth after the Hydraulic Jump. 7

b) A weir is constructed across a rectangular channel thereby rising the flow depth from 1.25m in a normal flow to 2.25m at the weir. The width of the channel is 10m and it is laid to a slope of 1:10000. Find an approximate length of backwater curve considering the average velocity, average depth and average slope midway between the two sections. Take manning's co-efficient as 0.02. 7

4. a) Distinguish between the friction drag and pressure drag. 4

b) On a flat plate of 2m×1m experiment were conducted in a wind tunnel of 50km/h. The plate is kept at such an angle that the coefficient of drag and lift are 0.18 and 0.90 respectively. Determine Drag force, lift force, resultant force and power exerted by the air stream on the plate. Take density of air = $1.15kg/m^3$. 10

OR

a) Differentiate between stream lined body and bluff body. 4