CE - 503
B.E. V Semester

Examination, December 2014

Fluid Mechanics - II

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out ofwhich part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Define

i) Boundary layer concept

ii) Aging of pipes.

b) Explain laminar sublayer.

c) What do you mean by water hammer? Explain gradual and instantaneous closure of valve.

d) A compound pipe system consists of 1800m of 50cm, 1200m of 40cm and 500m of 30cm pipes of the same material connected in series. What is the equivalent length of a 40cm pipe of the same material? Also calculate equivalent size of a pipe 3500m long?

OR

A smooth two-dimensional flat plate is exposed to a wind velocity of 360 km/hr. If the laminar boundary layer exists up to a value of $R_e = 2 \times 10^5$, find maximum distance from the leading edge up to which laminar layer exists and the maximum boundary layer thickness. The kinematic viscosity of air is $1.49 \times 1\ 0^{-5}$ m^2/sec. Density of air = 1.2 kg/m^3.

2. a) Define Hydraulic radius, wetted perimeter.

b) Distinguish between the subcritical flow and super critical flow.

c) What do you mean by most economical section of the channel? Explain the significance of most efficient section.

d) A rectangular channel 8m wide and 1.5m deep has a slope of 1 in 1000 and is lined with concrete. It is required to increase the discharge to a maximum by changing the dimensions of channel but keeping the same amount of lining. Calculate the new dimensions and the percentage increase in discharge. Take mannings constant for concrete as 0.015.

OR

A trapezoidal section has to be excavated in hard clay at minimum cost. Calculate the dimensions of the channel to give a discharge of 15 m^3/sec at a slope of 1:2500. Take manning's constants as 0.02.

3 a) Define the tenn Afflux and Back water curve.

b) What do you mean by “Standing Wave”"?

c) Explain the surges in open channel.

d) For a hydraulicjump in a rectangular channel the velocity and depth after the jump are known to be 0.80 m/s and 1.75 m respectively. Calculate the depth before thejump, the energy loss and the power dissipated per metre width.

OR

Derive an expression for discharge through a Venturi flume.

4 a) Define coefficient of drag and lift.

b) What is streamlining? What is its effect on the different types of drag?

c) What is magnus effect? Explain clearly.

d) A 0,80 cm diameter metallic ball of specific gravity 7.8 is allowed to fall in a fluid of specific gravity 0.90 and viscosity 1.4 N.S/m2.

Calculate :

i) Drag force exerted by fluid on the ball.

ii) Pressure drag and skin friction drag.

iii) Tenninal velocity of ball in fluid.

OR

A circular cylinder of 2.0m diameter and 12m length is rotated at 500 r.p.m. about its axis. When it is kept in an air stream of 40 in/s velocity with its axis perpendicular to the flow, determine:

i) Circulation around the cylinder

ii) Theoretical lift

iii) Position of stagnation point and

iv) Actual drag, lift and resultant force on the cylinder.

Take CD = 0.52, CL =1.0 and P = l.208 kg/m3.

5 a) Differentiate between the impulse and reaction turbines.

b) What is a draft tube? Why is it used?

c) Define manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal ptunp?

d) What are the characteristic curves ofa turbine? How are they obtained and what is their utility?

OR

A single acting reciprocating pump has a plunger of 80mm diameter and a stroke of length l50mm. lt takes its supply of water from a sump 3m below the pump through a pipe 4.5m long and 30mm diameter. lt delivers water to a tank 12m above the pump through a pipe 25mm diameter and 15m long. lf separation occurs at 78.48 kN/m2 below atmospheric pressure, find the maximum speed at which the pump may be operated without separation, assume the plunger to have simple harmonic motion.