Total No. of Questions : 12]

SEAT No. :

P2381

[Total No. of Pages :4

[5153]-4
T.E.(Civil)
FLUID MECHANICS-II
(2008 Pattern) (301004) (Semester-I)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Answer Section-I: Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Answer Section-II: Q.7 or Q.8, Q.9 or Q.10, Q.11 or Q.12.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right indicate full marks.***
6) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
7) ***Assume suitable data, if necessary.***

SECTION-I

Q1) a) Explain with neat sketches: **[8]**
- i) Total Drag
- ii) Profile Drag
- iii) Skin Friction Drag
- iv) Form Drag.

b) In a pressure penstock 4550 m long water is flowing at 4 m/s. If the velocity of the pressure wave travelling in the pipe due to sudden complete closure of a valve at the downstream end is given as 1505 m/s, Find:
- i) The maximum pressure rise
- ii) The period of Oscillation. **[6]**

c) Explain the water hammer phenomenon with respect to the gradual closure of valve in elastic pipes. **[4]**

OR

Q2) a) On a flat plate of 2.1 m length and 1.05 m width, experiments were conducted in a wind tunnel with a wind speed of 48.5 km/h. The plate is kept at such an angle that co-efficient of drag and lift is 0.18 and 0.9 respectively. Determine Lift, Drag resultant force and power exerted by air on the plate. **[8]**

b) Describe in brief: **[8]**
- i) Types of Unsteady Flow
- ii) Fluid Compressibility.

c) Explain the term " Karman Vortex Trail". **[2]**

P.T.O.

Q3) a) Derive the expression for the work done per second by the jet on the inclined plate moving in the direction of the jet. **[8]**

b) A centrifugal pump is to discharge 0.116 m^3/s at a speed of 1455 r.p.m. against head of 26 m. The impeller diameter is 240mm, its width at outlet is 60 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller. **[8]**

OR

Q4) a) A jet of water of diameter 80mm moving with velocity of 32 m/s, strikes a curved fixed plate tangentially at one end at an angle of 30^o to the horizontal. The jet leaves the plate at an angle of 20^o to the horizontal. Find the force exerted by the jet on the plate in the horizontal and vertical direction. **[8]**

b) Draw the neat sketch of centrifugal pump showing its component parts and explain its working also. **[8]**

Q5) a) A Pelton wheel is to be designed for the following specifications:

i) Power (brake or shaft) = 9570kW

ii) Head = 355 meters

iii) Speed = 740 r.p.m.

iv) Overall efficiency = 80%

v) Jet diameter = not to exceed 1/6th of the wheel diameter.

Determine the following:

1) The wheel diameter

2) Diameter of the jet, and

3) The number of jets required. **[8]**

b) A turbine is to operate under head of 27m at 210 r.p.m. The discharge is 9.5 m^3/s. If the efficiency is 90 percent determine the performance of turbine under a head of 21m. **[8]**

OR

Q6) a) Discuss the advantages and disadvantages of a Francis turbine over a Pelton wheel turbine. **[8]**

b) Derive the following expression for specific speed of a turbine with usual notations $N_S = \frac{N\sqrt{P}}{H^{5/4}}$ **[8]**

SECTION-II

Q7) a) Explain:

i) Classification of Channels

ii) Types of Channel Flows. **[8]**

b) A trapezoidal channel has side slopes of 3 horizontal to 4 vertical and slope of its bed is 1 in 1900. Determine the optimum dimensions of the channel, if it is to carry water at 0.55 m^3/s. Take Chezy's constant as 80. **[8]**

OR

Q8) a) A flow of water of 105 liters per second flows down in a rectangular flume of width 610mm and having adjustable bottom slope. If Chezy's constant C is 56, find the bottom slope necessary for uniform flow with a depth of flow of 295 mm. Also find the conveyance K of the flume. **[8]**

b) Derive the conditions for most efficient trapezoidal channel section. **[8]**

Q9) a) Explain:

i) Specific Force Diagram

ii) Specific Energy Curve. **[8]**

b) Derive the following expression for loss of energy due to hydraulic jump.

$$E_L = \frac{(y_2 - y_1)^3}{4 y_1 y_2}$$ **[8]**

OR

Q10)a) A 8.5 m wide rectangular channel conveys 15.50 m^3/s of water at a depth of 1.25m. Calculate:

i) Specific energy of the flowing water

ii) Critical depth, critical velocity and minimum specific energy

iii) Froude number and state whether the flow is subcritical or supercritical. **[8]**

b) Explain:

i) Classification of hydraulic jump

ii) Practical uses of hydraulic jump. **[8]**

Q11)a) Derive the following equation of the Gradually Varied Flow (G.V.F.). Also, State assumptions made for it. **[10]**

$$\frac{dy}{dx} = \frac{(s_o - s_f)}{\left[1 - (F_r)^2\right]}$$

b) Enlist the various methods of G.V.F. Computations. Explain any one method in detail. **[8]**

OR

Q12)a) Discuss in detail with neat sketches: **[12]**

i) Classification of channel bed slopes

ii) Various G.V.F. profiles

iii) Rapidly varied flow.

b) Find the slope of the free water surface in a rectangular channel of width 20.5 m, having depth of flow 5.1m. The discharge through the channel is 51 m^3/s. The bed of the channel is having a slope of 1 in 4100. Take the value of Chezy's constant C=65. **[6]**