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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2020

HYDRAULICS

[Maximum Marks: 75] [Time: 2.15 Hours]

PART-A

(Answer ***any three*** questions in one or two sentences. Each question carries 2 marks)

I. 1. Define mass density of fluid.

2. What do you mean by compressibility of fluid?

3. Define vena contracta.

4. What is the difference between a notch and a weir?

5. Define the following terms: (i) Hydraulic gradient line (ii) Total energy line. (3 x 2 = 6)

PART-B

(Answer any ***four*** of the following questions. Each question carries ***6*** marks)

II 1. A plate, 0.035 mm distant from a fixed plate, moves at 50 cm/s and requires a force of 1.75 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates in poise.

2. Derive an expression for determination of Cv in an orifice.

3. Explain the classification of orifice and mouthpiece based on their shape, size and sharpness.

4. A rectangular notch 0.5 m wide has a constant head of 400 mm. Find the discharge over the notch in litres per second, if the coefficient of discharge for the notch is 0.62.

5. Determine the height of a rectangular weir of length 6m to be built across a rectangular channel. The maximum depth of water on the upstream side of the weir is 1.8 m and discharge is 2000 litres/s. Take $C_d = 0.6$.

6. Derive an expression for the discharge through a channel by Chezy's formula.

7. A pipe 250 m long and of 75 mm diameter has a nozzle fitted at the discharge end. Find the diameter of the nozzle, so that maximum power may be transmitted. Take f = 0.01.

(4 x 6 = 24)

PART-C

(Answer ***any of the three units*** from the following. Each full question carries 15 marks)

UNIT – I

III (a) Determine the total pressure on a circular plate of diameter 2 m which is placed vertically in water in such a way that the centre of the plate is 3.5 m below the free surface of water. Find the position of centre of pressure also. (7)

(b) A U – tube differential manometer connects two pressure pipes A and B. Pipe A contains carbon tetrachloride having a specific gravity 1.8 under a pressure of 100 kPa. The pipe B contains oil of specific gravity 0.9 under a pressure of 190 kPa. The pipe A lies 3 m above pipe B. Find the difference of pressure measured by mercury as fluid filling U - tube. (8)

OR

IV (a) Derive an expression for the depth of centre of pressure of a vertical plane surface submerged in a liquid. (7)

(b) Water is flowing through a pipe having diameter 400 mm and 250 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 32.325 N/cm^2 and the pressure at the upper end is 12.32 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 60 litres. (8)

UNIT - II

V (a) Derive an expression for

(i) Discharge through fully submerged orifice

(ii) Discharge through partially submerged orifice. (8)

(b) The head of water over an orifice of diameter 90 mm is 8 m. The water coming out from orifice is collected in a circular tank of diameter 2 m. The rise of water level in circular tank is 1 m in 35 seconds. Also, the co-ordinates of a point on the jet measured from vena contracta are 3.5 m horizontal and 0.5 m vertical. Find the coefficients C_d, C_v and C_c. (7)

OR

VI (a) Explain the working of francis turbine and Kaplan turbine. (8)

(b) Discuss about the centrifugal pumps and reciprocating pumps (7)

UNIT- III

VII (a) Derive an equation for discharge over a trapezoidal notch. (7)

(b) Water flows through a triangular right-angled weir first and then over a rectangular weir of 1 m width. The discharge coefficients of the triangular and rectangular weirs are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360 mm, find the depth of water over the rectangular weir. (8)

OR

VIII (a) What do you understand by 'velocity of approach'? Find an expression for the discharge over a rectangular weir with velocity of approach. (7)

(b) Draw a general layout of a hydro-electric power plant and explain the following terms:

(i) Penstock (ii) Gross Head (iii) Tail race. (8)

UNIT - IV

IX (a) Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the ends of a pipe 500 m apart is 4 m of water. Take the value of f = 0.009 in Darcy's formula. (7)

(b) An old water supply distribution pipe of 250 mm diameter is to be replaced by two parallel pipes of equal lengths and identical values of coefficient of friction. Find the diameter of new pipes. (8)

OR

X (a) A channel has two sides vertical and semi – circular bottom of 2 m diameter. Calculate the discharge of water through the channel, when the depth of flow is 2 m. Take C = 70 and slope of bed as 1 in 1000. (7)

(b) A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and the slope of the bed is 1 in 1500. The area of the section is 40 m^2. Find the dimensions of the section if it is most economical. Determine the discharge of the most economical section if C = 50. (8)
