Fluid Mechanics - II

P. Pages : 3 **KNT/KW/16/7377**

Time : Three Hours Max. Marks : 80

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Notes : 1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Derive Hagen-Poiseuille equation and write the assumptions made in it. **6**

b) Calculate the diameter of a parachute to be use for dropping on object weighing 980 N so that the maximum terminal velocity of dropping is 5 m/sec. The drag coefficient for the parachute which may be treated as hemispherical is 1.3. The density of air is 1.22 kg/m^3. **7**

OR

2. a) Describe in brief various ways in which boundary layer thickness is defined. **6**

b) What is mean by Drag Force & Lift force and what are the differents types of Drag? **7**

3. a) Explain : **6**

i) Hydraulically smooth and rough boundaries.

ii) Total Energy line & Hydraulic Grade line.

b) Three pipes are connected in parallel between two reservoirs having water level difference of 15m. The details is given below. **7**

Pipe I	L = 1.2 km	D = 0.8 m	F = 0.03
Pipe II	L = 1.0 km	D = 0.65 m	F = 0.03
Pipe III	L = 1.5 km	D = 1.0 m	F = 0.02

a) Determine Discharge through each pipe & Total Discharge.

b) Also calculate diameter of single pipe required to replace three pipes with Length L = 1.2 km & F = 0.03.

OR

4. A Pipe network consists of two loops formed by five pipes AB, BC, CD, DA & BD. The in-flow at A is 70 m^3/sec & that at 'c' is 50 m^3/sec. The outflows at 'B' & D are 40 m^3/sec & 80 m^3/sec respectively. The values of K in the Friction loss formula $h_f = K \cdot Q^2$ is given below. **13**

Pipe :	AB	BC	CD	DA	BD
K :	3	4	2	2	1

Analyze the pipe network using Hardy - Cross method.

5. a) Define : **6**
   a) Conveyance of channel.
   b) Section Factor.
   c) Alternate Depth.

   b) A Rectangular channel cross section having base width of 2m & depth of Flow 1.5m. Bed slope is 1 in 2000 is to be converted into most economical trapezoidal cross section with side slope 1:1.5, so as to carry same discharge with same bed slope. Determine dimension of trapezoidal section. Take N = 0.016. **7**

OR

6. a) Derive the equation for critical depth for a wide rectangular channel. **6**

   b) A triangular channel with vertex angle of 120^0 has carry discharge 2 m^3/sec. Determine the critical depth & minimum specific energy. **7**

7. a) Give the classification & characteristics of surface profiles. for steep slope & critical slope. **6**

   b) A rectangular channel of width 8 m has bed slope of 1 in 100 with manning's constant N = 0.024. If the normal depth is 1.55 m. what is the normal discharge? The depth of Flow increases to 4.0 m behind dam in the channel. How for upstream of dam is a depth of 2 m likely to occure. **8**

OR

8. a) Define hydraulic Jump. What are the different types of hydraulic Jump based on Froude number? Also write uses of hydraulic jump. **6**

   b) A hydraulic jump is formed in rectangular channel with super critical flow velocity 12 m/sec & ratio of sequent depth is 11.5. Determine. **8**
   a) Depth of Jump
   b) Initial Froude number.
   c) Head loss.
   d) Energy loss as % of Initial.

9. a) Explain. **6**
   a) Froude model law.
   b) Reynold's model law.

b) Explain. **7**

a) Distorted model.

b) Similitude & types of similarity.

OR

10. a) A spillway 8m high & 14m long Discharges 90 m^3/sec. Water under a head of 3.0m. If a 1:20 scale model of thin spillway is constructed. Find the model dimensions, head over the model & the model discharge. **6**

b) An orifice meter to carry water is calibrated with air in a geometrically similar model at 1/5 prototype scale. Determine discharge ratio (air to water) so that dynamically similar flow will be obtained. Assume the ratio of kinematic viscosity of air to water as 13.5. **7**

11. a) Draw the neat sketch of centrifugal pump & explain the function of each unit. **6**

b) A single acting reciprocating pump running at 60 rpm delivers 0.00786 m^3/sec. of water. The diameter of piston is 200 mm & stroke length 300 mm. Suction & delivery head are 4.0m. & 12.0m respectively. Determine. **8**

i) Theoretical discharge. ii) Coefficient of discharge.

iii) % slip. iv) Power required to run pump.

OR

12. a) Explain differents types of Heads and Efficiency of turbine. **7**

b) Under a head of 200m at 500rpm, a turbine develops 550kw of power. Determine its normal speed and output under a head of 120m. **7**

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