



- 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.

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 1.22kg/m^3 . 7

OR

2. a) What do you mean by coefficient of drag and coefficient of lift? 5
 b) In a fluid mechanics laboratory it was asked to conduct an experiment on a flat plate of 2m long and 1.2m wide in a wind tunnel with a wind velocity of 40 km/h. When the plate is kept at 6° angle of attack, the coefficient of lift and drag are computed as 0.70 and 0.18 resp. find the a) Lift force b) Drag force c) Magnitude and direction of resultant force. Density of air is 118N/m^3 . 8
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 $L = 1.2\text{ km}$ $D = 0.8\text{ m}$ $F = 0.03$
 Pipe II $L = 1.0\text{ km}$ $D = 0.65\text{ m}$ $F = 0.03$
 Pipe III $L = 1.5\text{ km}$ $D = 1.0\text{ m}$ $F = 0.02$

OR

4. a) Determine the equivalent pipe corresponding to 3 pipes in series with lengths and diameters $L_1, L_2, L_3, D_1, D_2, D_3$. Respectively. 6

- b) A single uniform pipe joins two reservoirs. Calculate the percentage increase of flow rate obtainable if, from the midpoint of this pipe, another of the same diameter is added in parallel to it. Neglect all losses except pipe friction and assume a constant and equal for both pipes. 7
5. a) Define: 7
- i) Conveyance of channel.
 - ii) Section Factor.
 - iii) 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 slop. Determine dimension of trapezoidal section. Take $N = 0.016$. 7

OR

6. a) Differentiate between. 6
- i) Subcritical flow and supercritical flow.
 - ii) Uniform and non-uniform flow.
 - iii) Specific energy and specific force.
- b) Show that the Froude number at critical depth in a rectangular channel is unity. Also derive the expression for critical depth in a rectangular channel. 8
7. a) Give the classification & characteristics of surface profiles. For steep slope & critical slope. 6
- b) A rectangular channel of width 8m has bed slope of 1 in 100 with manning's constant $N = 0.024$. If the normal depth is 1.55m. What is the normal discharge? The depth of Flow increases to 4.0 m behind dam in the channel. How far upstream of dam is a depth of 2m likely to occur. 7

OR

8. a) Prove the loss of energy head in a hydraulic Jump. 6
- b) A hydraulic jump takes place in a rectangular channel with its initial and sequent depths of 0.6 m and 2.4m respectively. Determine. 7
- i) The discharge per meter width.
 - ii) The possible critical depth for this discharge.
 - iii) Energy loss in the jump.
9. a) Explain. 6
- i) Froude model law.
 - ii) Reynold's model law.
- b) Explain. 7
- i) Distorted model.
 - ii) Similitude & types of similarity.

OR

10. a) What do you mean by undistorted models and distorted models? 4
- b) Differentiate between kinematic similarity and dynamic similarity. 3
- c) A 1810 scale model of a passenger car is tested in a wind tunnel to measure the drag on a proposed design. A prototype speed of 120km/h is desired. What speed should be used in the wind tunnel for the model study? 6
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 m³/sec. of water. The diameter of piston is 200 mm & stroke length 300mm. Suction & delivery head are 4.0m & 12.0m respectively. 8
Determine.
i) Theoretical discharge.
ii) Coefficient of discharge.
iii) % Slip.
iv) Power required to run pump.

OR

12. Write short notes on **any four**. 3¹/₂ x 4
=14
- i) Priming in centrifugal pump.
- ii) Separation phenomenon in centrifugal pump.
- iii) Indicator diagram for reciprocating pump.
- iv) Positive displacement pump.
- v) Necessity of Air vessels.
