B.E. (Civil Engineering) Sixth Semester (C.B.S.)

Fluid Mechanics - II

P. Pages : 2 **TKN/KS/16/7465**

Time : Three Hours Max. Marks : 80

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. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) An oil with density 9000 N/m^3 and viscosity 0.18 $N\text{-}s/m^2$ flows through a 10 cm diameter horizontal pipe. The pressure drop over a 10 m length of pipe is 10 kPa. Determine the average velocity and the rate of flow. **7**

b) What is meant by boundary layer thickness, displacement thickness and momentum thickness? **6**

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 6º 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 118 N/m^3. **8**

3. a) Derive an expression for Darcy-Weisbach formula to determine the head loss due to friction. **6**

b) Water at 20ºC is flowing steadily through a 5cm long pipe at a rate 2.5 lit. per minute. Find the shear stress on the internal wall of the pipe. Consider dynamic viscosity 0.001 $N\text{-}s/m^2$. **7**

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. **7**
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.

5. a) Define the following terms related to flow in open channel. **6**
i) Wetted perimeter. ii) Hydraulic radius. iii) Slope of the bed.

	b)	An earthen channel with a base width 4 m and side slope 1:2 carries water with a depth of 1m. if the slope of the bed of the channel is 1:1000, find the discharge and the average shear stress at the channel boundary. Assume manning constant 0.03.	**8**

OR

6.	a)	Differentiate between. i) Subcritical flow and supercritical flow. ii) Uniform and non-uniform flow. iii) Specific energy and specific force.	**6**
	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)	Show that the variation of depth of flow along the length of the bed of the channel for steady gradually varied flow in an open channel is given by $\frac{dy}{dx}=\frac{s_o-s_f}{1-{f_r}^2}$.	**6**
	b)	Water is flowing through a rectangular channel of 5 m wide with a velocity of 1.2 m/sec. The slope of the channel is 1 in 2000 and the depth of flow is 2m. If the flow is regulated in such a way that the slope of the energy line is 0.00008, find the rate of change of depth of water in the channel.	**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 2.4 m respectively. Determine. i) the discharge per meter width. ii) the possible critical depth for this discharge. iii) energy loss in the Jump.	**7**
9.	a)	What do you mean by similitude and what are the different types of similarities that must exist between a model and a prototype.	**6**
	b)	A model of reservoir is completely drained in 5 minutes by means of a sluice gate. If the model is built to a scale of 1:400, what time will be required to drain the prototype?	**7**

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 mind tunnel for the model study?	**6**
11.	a)	Define hydraulic efficiency, overall efficiency and mechanical efficiency. Show that $\eta_o=\eta_h\times\eta_m$.	**8**
	b)	A turbine with an overall efficiency of 90% is to be installed in a hydroelectric plant. The head and discharge available at the plant are 30m and 15 m^3/sec. respectively if the turbine has to run at 150 rpm, determine the power developed, specific speed and type of the turbine.	**6**

OR

12.		Write short notes on **any four.** 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.	**3½x4 =14**

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