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

# Fluid Mechanics - II

P. Pages : 3 **NKT/KS/17/7377**

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. 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) Define various thicknesses of boundary layer with the equations. **6**

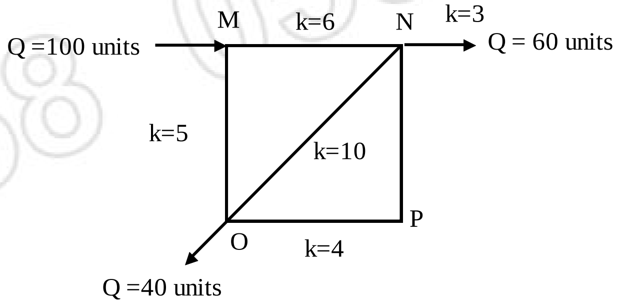
b) An oil having viscosity of 1 poise and specific gravity 0.85 Flows through a pipe 30 mm diameter. If pressure drop per meter length of the pipe is 15 KPa, determine the flow through the pipe, the shear stress at the pipe wall, the Raynolds number of the flow and the power required for 40 m length of the pipe to maintain the flow. Define various thicknesses of boundary layer with the equations. **7**

**OR**

**2.** a) Explain the development of boundary layer along a thin, flat and smooth plate held parallel to uniform flow. Point out the silent features. **6**

b) A body having a projected area of 1.3 $m^2$ experiences a drag of 201 N when traveling through air at a velocity of 90 km/hr with the projected area perpendicular to the direction of travel. If the mass density for air is 1.208 $Kg/m^3$, determine the drag coefficient. **7**

**3.** For the pipe network as shown in fig. obtain the discharge in each pipe of the network by Hardy Cross method (Do maximum two iterations.) **14**




**OR**

4. a) The elevation of the water levels in two reservoirs A and B are 115 m and 60 m resp. These two reservoirs are connected by a siphon over a summit where pipeline elevation is 160 m. The pipe is 30cm in diameter and 950 m long from reservoir A to reservoir B and 400 m long from reservoir A to the summit. Estimate the discharge and the pressure at the summit, if f = 0.024. **7**

b) Three pipes of diameters 300 mm. 200 mm and 400 mm and length 300 m, 170 m and 210 m respectively are connected in series between two water tanks. The difference in water surface levels in two tanks is 12 m. Determine the rate of flow if friction factors are 0.02, 0.022 and 0.024 respectively considering minor losses. **7**

5. a) A rectangular open channel has following details: **7**
   i) Discharge = 16 $m^3$/sec
   ii) Bed Width = 10 m
   iii) Depth of water = 1.0 m. Find:
      i) Specific Energy
      ii) Critical Depth
      iii) Critical velocity
      iv) Minimum specific energy required for this discharge.

b) A trapezoidal channel section has side slopes of 3 horizontal to 4 vertical and the slope of its bed is 1 in 2000. Determine most economical channel section, if it has to carry discharge of 1 Cumec. Take Chezy's constant = 80 **7**

**OR**

6. a) A rectangular channel carries a discharge of 30 $m^3$/sec with an average velocity of 7 m/s. If Chezy's constant is 65 $m^{½}$/s, determine the most economical cross-section of the channel. **7**

b) A flow of 6 $m^3$/min flows down a rectangular flume in a lab. The width of flume is 500 mm. If Chezy's constant is 60, find the bottom slope necessary to produce a flow depth of 300 mm. **7**

7. a) A rectangular channel 5 m wide carries a discharge of 15 $m^3$/sec at a velocity of 10 m/sec. If a hydraulic jump occurs, Find: **6**
   i) Depth of flow after jump
   ii) Energy loss in jump
   iii) Height of jump.

b) A rectangular channel 10 m wide carries a discharge of 30 $m^3$/ sec at a normal depth of 2.97 m. It is laid at a slope of 0.0001. If at a section in this channel, depth of flow is 1.6m, How far upstream or downstream from this section will the depth be 2.0 m? Take manning's n=0.015. Classify the surface profile. **7**

**OR**

8. a) Draw the water surface profiles for **6**
   i) Mild Slope

   ii) Steep Slope

b) A rectangular channel of width 12 m carries a discharge of 46 $m^3$/sec. If depth of flow at a section is 4.1 m, find the depth of flow alternate to this depth. **7**

**9.** a) In a 1:30 model of spillway, the velocity and discharge are 1.5 m/sec and 2 $m^3$/sec. Find the corresponding velocity and discharge in the prototype. **6**

b) Explain Similarities in model. **7**

**OR**

**10.** Explain briefly: **any three.** **13**

i) Reynold's model law

ii) Froude's model law.

iii) Distorted and undistorted models.

iv) Froude's method for modeling partially submerged bodies.

**11.** a) A hydraulic turbine develops 580 KW under a head of 15 m and given an efficiency of 90 %. Calculate specific speed of the turbine. Also calculate power generated if the head is reduced to 7 m. Assume N = 400 rpm. **6**

b) A single acting reciprocating pump has a plunger diameter of 50 cm & a stroke length of 100 cm. If the speed of the pump is 80 rpm & coefficient of discharge is 0.95, determine the actual discharge & the % slip of the pump. **7**

**OR**

**12.** a) At a design speed of 1000 r.p.m. at centrifugal pump is to deliver water against at a head of 5.0 m. The vanes are curved backyard to an angle of 30º with the periphery. The impeller diameter is 30 cm, the outlet width is 5 cm. What will be the discharge if the hydraulic efficiency of the centrifugal pump is 94%? **6**

b) Write short note on: **7**

i) Heads and efficiency of a turbine.

ii) multistage Centrifugal Pump.

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