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

Fluid Mechanics – II

P. Pages : 3 **NIR/KW/18/3461**

Time : Three Hours * 1 2 5 3 * 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. 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 $1.22 kg/m^3$. **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 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) 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

OR

4. a) Determine the equivalent pipe corresponding to 3 pipes in series with lengths and diameters L1, L2, L3, D1, D2, D3. 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 for 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. **7**
Determine.
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 mind 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.** **$3^1/_2$x4 =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.

****

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

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**

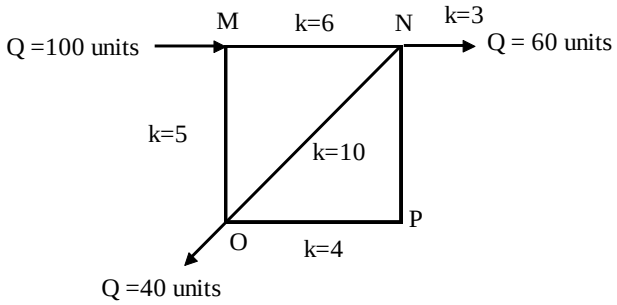
b) An oil having viscosity of 1 poise and specific gravity 0.85 Flows through a pipe 30 mm diameter. If pressure drop per meter length of the pipe is 15 KPa, determine the flow through the pipe, the shear stress at the pipe wall, the Raynolds number of the flow and the power required for 40 m length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

****

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

Fluid Mechanics - II

P. Pages : 2 **NJR/KS/18/4516**

Time : Three Hours * 0 7 8 1 * 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) Oil of absolute viscosity 1.5 poise and relative density 0.85 flows through a 30 cm diameter pipe. If the head loss in 3000 m. length of pipe is 20 m, estimate : (i) The shear stress at the pipe wall (ii) The friction factor 'f' by assuming the flow to be laminar. **7**

b) Calculate the weight of the ball of diameter 80 mm which is just supported in a vertical air stream which is flowing at a velocity of 7 m/s. The density of air is given as $1.25 kg/m^3$. The kinematic viscosity of air 1.5 stokes. **7**

OR

2. a) Write short notes on : **7**
i) Stoke's law
ii) Karman's vortex trail.

b) Derive the expression for shear stress distribution and velocity distribution for laminar flow in a circular pipe. **7**

3. a) Explain the term Hydrodynamically smooth and rough surfaces. **5**

b) Two reservoirs are connected by a pipe line consisting of two pipes in series, one of 15 cm diameter and 6 m long and another of 22.5 cm diameter and 15 m long. If the difference in water levels of the reservoirs is 6.0 m. Find the discharge considering all losses $f = 0.02$. **8**

OR

4. Three reservoir A, B and C with water surface elevations 40 m, 15 m and 10 m respectively and connected by three pipes by common junction J. The pipe details are **13**

Pipe	Dia. (mm)	Length (m)	Value of 'f'
AJ	600	900	0.021
BJ	450	500	0.022
CJ	400	1200	0.020

Estimate the discharge in each pipe and the value of the HGL at the junction J.

5. a) Derive Chezy's formular for flow through open channel and determine the dimensions of Chezy's constant C. **6**

b) A triangular channel with its vertex down wards has side sloping at 1.5 (H) to 1 (V) and laid on longitudinal bed slope of 1 in 2000. Assuming manning's n = 0.015, estimate the normal depth corresponding to discharge of $0.3 m^2/s$. **7**

OR

6. a) Prove that for a given value of specific energy discharge is maximum in a channel when the flow is critical. **6**

b) A rectangular channel has a width of 2 m and carries a discharge of $2 m^3/s$ with a depth of 0.25 m calculate : **7**

i) Specific energy.
ii) Depth alternate to existing depth
iii) Critical depth and specific energy at that depth.

7. a) Give the classification and characteristics of m and s surface profiles. **6**

b) Derive the GVF equation and list the various assumptions made there in. **7**

OR

8. a) Define hydraulic jump. classify it on the basis of Froude's number. **6**

b) Water flows in a rectangular channel 0.6 m wide at a depth of 0.18 m at a Froude number 2.75, find (i) Height of Jump, (ii) Sequent depth, (iii) Energy loss in Jump. **7**

9. a) Explain similitude and types of similarity. **5**

b) In 1830 model of spillway, the velocity and discharge are $1.5 m/s$ and $20 m^3/s$. Find the corresponding velocity and discharge in the prototype. **8**

OR

10. Write short notes on : **13**

i) Froude's model law.
ii) Distorted model.
iii) Derive model scales for velocity and time.

11. a) Distinguish between impulse and reaction turbines with regard to their operation and application. **4**

b) Explain the efficiencies of hydraulic turbines. **4**

c) A Pelton wheel develops 4000 kw under a net head of 120 m at a speed of 200 rpm. Assuming $C_V = 0.98$, speed ratio = 0.46, efficiency 0.80 and the jet diameter 1/9, determine the flow required and the diameter of the wheel. **6**

OR

12. Write notes on **any three.** **14**

i) Specific Speed of a centrifugal pump.
ii) Centrifugal pump and its component parts.
iii) Slip, % slip and negative slip in case of a reciprocating pump.
iv) Air vessel of a reciprocating pump.

****

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

Fluid Mechanics - II

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

Time : Three Hours * 0 0 9 1 * 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. 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**

****