Section D

7. What are the characteristic curves of a hydraulic turbine ? How are they useful to practical engineer ? How are the small sales models useful in obtaining these curves for a proposed turbine of hydroelectric installation ? **15**

8. Determine the maximum speed at which a double acting reciprocating pump can be operated under the following conditions :

(a) No air vessel on the suction side;

(b) A very large vessel on the suction side close to the pump. The suction lift is 4 m length of suction pipe is 6.5 m, diameter of suction pipe is 100 mm, diameter of piston 150 mm and length of stroke is 0.45 m. Assume simple harmonic motion, atmospheric pressure head as 10.3 m of water separation occurs at 2.6 m of water absolute. Take Darcy's $f = 0.024$. **15**

(Compulsory Question)

9. Answer the following questions in brief : **1½×10=15**

(a) Explain laminar and turbulent flows in pipes and open channels.

J-21-0004

B.Tech. EXAMINATION, 2021

Semester V (CBCS)

MECHANICS OF FLUIDS-II

CE-504

Time : 2 *Hours* *Maximum Marks :* 60

The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.

Note : Attempt *Four* questions in all, selecting *one* question from any of the Sections A, B, C and D. Q. No. **9** is compulsory.

Section A

1. Two parallel plates kept 0.1 m apart have laminar flow of oil between them with a maximum velocity 1.5 m/s. Calculate the discharge per metre width, the shear stress at the plates. The difference in pressure

in Pascals between two points 20 m apart, the velocity gradient at the plates and velocity at 0.02 m from the plate. Take viscosity of the oil to be 2.453 N.s/m^2.

15

2. Air flows over a flat plate 1 m long at a velocity of 6 m/s. Determine the boundary layer thickness at the end of the plate, shear stress at the middle of the plate and total drag per unit length on the sides of the plate. Kinematic viscosity = 0.15×10^{-4} m^2/s for air.

15

Section B

3. A flow of 100 litres per second flows down in rectangular laboratory flume of width 0.6 m and having adjustable bottom slope. Determine the slope necessary for uniform flow with a depth of flow 0.3 m. Also find the conveyance and the state flow (i.e. tranquil or rapid). Take Chezy's constant = 56.

15

4. In a rectangular channel 3.5 metre wide laid at a slope of 0.0036, uniform flow occurs at a depth of 2 m. Find, how high can the hump be raised without causing afflux ? If the upstream depth of flow is to be raised to 2.5 m, what should be the height of the hump, if Manning's coefficient is taken as 0.015 ?

15

Section C

5. A rectangular channel 7.5 m wide has uniform depth of 2.0 m and has a bed slope of 1 in 3000. If due to weir constructed at the downstream end of the channel, water surface at a section raised by 0.75 m, determine the water surface slope with respect to horizontal at this section. Assume Manning's $n = 0.02$.

15

6. A trapezoidal channel having bottom width 8 m and side slope 1 : 1, carries a discharge of 80 m^3/s. Find the conjugate depth to initial depth of 0.75 before the jump. Also determine the loss of the energy in the jump.

15

(b) State the Stokes' Law.

(c) Describe the displacement and momentum thicknesses of boundary layer.

(d) Differentiate between open channel and pipe flows.

(e) Explain the chocking conditions in open channels.

(f) At what conditions M1, M2 and M3 profiles are formed in open channels ?

(g) Enumerate the methods for the computations of flow profiles in open channels.

(h) Discuss the assumptions made in the derivation of the dynamic equation for gradually varied flow.

(i) Describe the different type of pumps and their criterion to uses in the field.

(j) Explain unit discharge and unit power of a hydraulic turbine.