6. (a) Derive an equation for uniformly progressive flow (monoclinical wave) in a open channel.(7)

(b) A river having as average depth of 2.5 m joint the sea at a velocity of 1.2 m/s. If a sea bore travelling upstream increases the depth to 4 m, what is the velocity of the bore and river velocity downstream of the bore. (7)

7. (a) Derive an Dynamic equation for unsteady flows in an open channel. (7)

(b) Write short notes on the following :

(i) Flood Routing Concepts (4)

(ii) Reservior routing. (3)

8. Write short notes on the following :

(a) Dimensionless Numbers. (4)

(b) Velocity triangles for a pelton turbine bucket (3)

(c) Water hammer (3)

(d) Performance characteristics of pump. (4)

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[2546/3/I/13]

[01 – 3214]

III/IV B.E. DEGREE EXAMINATION.

Second Semester

Civil Engineering

FLUID MECHANICS – III

(Common with Civil Environmental Engineering and M.S. Civil Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Answer any FIVE of the following.

First question is compulsory.

1. (a) Explain the term 'dimensionally homogeneous equation'.

(b) What is a Draft tube? What are its functions?

(c) What is primary? Why it is necessary?

(d) Define Slip, Percentage Slip of a reciprocating pump.

(e) Define Positive and Negative Surges.

(f) What are the design principles of surge tanks?

(g) Define the efficiencies of a Centrifugal pump.

2. (a) What do you mean by repeating variables? How are the repeating variables selected for dimensional analysis? (4)

(b) A 1 in an 20 model of a naval ship having a sub-merged surface area of $5m^2$ and length 8m has a total drag of 20N when towed through water at a velocity of 1.5 m/s. Calculate the total drag on the prototype when moving at the corresponding speed. The surface drag coefficient c_f in the model and prototype was 2.5×10^{-3} and 1.2×10^{-3} respectively. (10)

3. (a) Define specific speed of a turbine and derive an expression for the turbine. (6)

(b) A Pelton wheel is to be designed for the following specifications

Power = 735.75 KW shaft power.

Head = 200 m

Speed = 800 r.p.m.

n_0 = 0.86 and jet diameter is not to exceed one-tenth the wheel diameter. Determine

(i) Wheel diameter

(ii) The number of jets required

(iii) Diameter of the jet. Take C_v =0.98 and speed ration = 0.45. (8)

4. (a) Define a centrifugal pump. Explain the working of a single-stage centrifugal pump with sketches. (6)

(b) The impeller of centrifugal pump is 250 mm in diameter, 50 mm wide at the periphery and has blades whose tip angles are inclined backwards 30°. Calculate the speed of the water leaving the impeller. The pump delivers 0.118 m^3/s and the impeller rotates 1450 r.p.m. Assuming the pump is designed to admit radially, calculate the shaft power required and the total lift of the pump, taking mechanical efficiency as 95% and hydraulic efficiency as 45%. (8)

5. (a) Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump. (6)

(b) A double-acting reciprocating pump, running at 50 r.p.m. is discharging 900 litres of water per minute. The pump has a stroke of 400 mm. The diameter of piston is 250 mm. The delivery and suction heads are 25 m and 4 m respectively. Find the slip of the pump and power required to drive the pump.