Part–IV

7. (a) What is model testing in hydraulic machines ? Explain the advantages and application of these testing. 10

(b) What do you mean by cavitation in hydraulic turbines ? How can it be avoided ? Also enlist some factors responsible for this phenomenon. 10

8. Write short notes on the following (any *two*) :

(i) Torque converter

(ii) Hydraulic Ram

(iii) Air lift pump. 2×10=20

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BT–5 / D 12

FLUID MACHINES

Paper–ME–303 E, Opt. (II)

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions in all, at least selecting **one** question from each part.*

Part–I

1. The pressure difference ΔP in a pipe of Diamter 'D' and length 'ℓ' due to turbulent flow depends upon the velocity V, viscosity μ, density ρ, and roughness 'K'. Using Buckingham's π-Theorem, obtain an expression for ΔP. 20

2. A 30 mm diameter jet strikes without shock on a series of vanes. The jet velocity is 60 m/s and the vanes move in the same direction as the Jet. The shape of each vane is such that, when stationary, it would deflect the Jet through an angle of 150°. The friction reduces the relative velocity by 10% as water flows accross the vanes and there is a further windage loss given by $\frac{u^2}{2}$ Nm/kg of water, where u is the vane speed.

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Determine

(i) The velocity of vanes corresponding to maximum efficiency.

(ii) The corresponding thrust on the vanes in the direction of motion.

Part–II

3. (a) Draw a general layout of a hydroelectric power plant using a reaction turbine. 6

(b) Derive an expression for maximum hydraulic efficiency of a Palton wheel. 8

(c) What are the functions of a Draft tube in a reaction turbine ? 6

4. The following data relates to a Kaplan Turbine. Power available at the shaft = 22500 kW; Head = 20 m; Speed = 150 rpm; Hydraulic efficiency = 95%; overall efficiency = 88%, outer diameter of runner = 4.5 m diameter of the nub = 2 m.

Assuming that the turbine discharges without whirl at exit, determine the runner vane angles at the nub and at the outer periphery. 20

Part–III

5. (a) What is the effect of number of vanes of impeller on head and efficiency in case of a centrifugal pump. 6

(b) A centrifugal pump impeller runs at 80 rpm and has outlet vane angle of 60°. The velocity of flow is 2.5 m/s throughout and diameter of the impeller at exit is twice that at inlet. If the manometric head is 20 m and the manometric efficiency is 75 percent, determine

(i) The diameter of impeller at the exit

(ii) Inlet vane angle. 14

6. (a) What is negative slip in a reciprocating pump ? Explain the function of air vessels with neat sketches. http://www.kuonline.in 6

(b) Draw an indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes. Find an expression for the work done per second in case of a single acting reciproacting pump. . 8

(c) What is NPSH ? Discuss its importance. 6