(Please write your Exam Roll No.) Exam Roll No. 05125603414

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] MAY-JUNE 2016

Paper Code: ETCE-206	Subject: Hydraulics and Hydraulic Machines
Time: 3 Hours	Maximum Marks: 75

Note: Attempt any five questions including Q.no.1 which is compulsory. Select one question from each unit.

Q1 Attempt all the questions: **(5x5=25)**

(a) What is the concept of boundary layer and what are the different boundary layer parameters?

(b) Discuss different types of drags on immersed bodies.

(c) What is cavitation and how it effects can be reduced?

(d) What is net positive suction head (NPSH)?

(e) Classify hydraulic turbines on the basis of head, discharge and specific speed.

Unit-I

Q2 Determine the direction and amount of flow per meter width between two parallel plates when one is moving relative to the other with a velocity of 3 m/s in the negative x-direction, if $\frac{dp}{dx} = -100\ N/cm^2cm$, μ is 0.4 poise and the distance between the plate is 1 mm. **(12.5)**

Q3 Air at 25^0 C and 1 bar flows over a flat plate at a speed of 1.25 m/s. Calculate the boundary layer thickness at distance of 15 cm and 30 cm and from the leading edge of the plate. What would be the mass entrainment (mass flow entering the boundary layer) between these two sections? Assume parabolic velocity distribution.

$$\frac{u}{U_0} = \frac{3}{2}\left(\frac{y}{d}\right) - \frac{1}{2}\left(\frac{y}{d}\right)^3$$

The viscosity of air at 25^0 C is stated to be 6.62 x 10^{-2} Kg/hr-m. **(12.5)**

Unit-II

Q4 What do you understand by commercial pipes? How would you determine the equivalent roughness of a commercial pipe?

A 20 cm diameter pipe has a relative roughness (R/ε) of 100. After 10 years of service, the relative roughness drops to 80. Determine the magnitude of the rate of roughness increase. **(12.5)**

Q5 What is Magnus effect? Cite some practical examples which illustrate the manifestation of this effect.

A ship has two vertical rotors, 2.5 m in diameter and 8 m high. When the rotors are spun at 240 rpm, the relative motion of air to the ship results in 50 km/hr of wind. Calculate the force exerted on the ship by the spinning rotors. Take density of air as 1.24 kg/m^3. **(12.5)**

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Unit-III

Q6 Explain the characteristic features of the cup of a Pelton wheel. What are the limitation in keeping the deflection angle of the cup as 180^0?
A Pelton wheel semi-circular buckets function under a head of 150 m and consumes 50 liters/sec of water. If 60 cm diameter wheel turns 600 revolutions per minute, make calculations for the power available at the nozzle and the hydraulic efficiency of the wheel. Presume coefficient of Velocity K_v as unity. **(12.5)**

Q7 How the slow, medium and fast runners of a Francis turbine are specified?

A reaction turbine works at 450 rpm under a head of 120 meters. Its diameter at inlet is 120 cm and the flow area is 0.4 m^2. The angles made by the absolute and the relative velocities at inlet are 20^0 and 60^0 respectively with the tangential velocity. Determine (i) the volume flow rate (ii) the hydraulic power developed and (iii) the efficiency. Assume whirl at outlet to be zero. **(12.5)**

Unit-IV

Q8 How does a centrifugal pump impart pressure energy to the flowing fluid?

The axis of a centrifugal pump is 2.5 m above the water level in the sump and the static lift from the pump centre is 32.5 m. The friction losses in the suction and delivery pipes are 1 m and 8 m respectively; suction and delivery pipes are each 12 cm in diameter. At outlet the diameter and width of the impeller are 30 cm and 1.8 cm respectively and the vanes are set back at an angle of 30^0 with tangent to the wheel. For the speed of 1800 rpm, mechanical efficiency 0.75 and monometric efficiency 80%, make calculations for the discharge and the power required to drive the pump. Assume radial entry. **(12.5)**

Q9 Explain the working principal of reciprocating pump. Why a reciprocating pump is called a positive displacement pump?

A single acting reciprocating pump has the plunger diameter of 20 cm and stroke of 30 cm. The pump discharges 0.53 m^3 of water per minute at 60 rpm. Find the theoretical discharge, co-efficient of discharge, and percentage slip of pump. Further, if suction and delivery heads are 4 m and 12 m respectively work out power required to run the pump. **(12.5)**

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