B.TECH SEM – VI (2007 COURSE) (MECHANICAL ENGG.) :
SUMMER - 2018
SUBJECT: FLUID MACHINERY

Day : **Friday** | **S-2018-2732** | Time : **02.30 PM TO 05.30 PM**
Date : **08/06/2018** | Max. Marks: 80

N. B. :

1) **Q. No.1** and **Q. No.5** are **COMPULSORY.** Out of the remaining attempt **ANY TWO** questions from each section.
2) Figures to the right indicate **FULL** marks.
3) Answer the both sections in **SEPARATE** answer books.
4) Assume suitable data, if necessary.
5) Draw neat and labeled diagrams **WHEREVER** necessary.

SECTION-I

Q.1 **a)** Show that the force exerted by a jet of water on moving inclined plate in the direction of jet is given by: **(05)**

$$F_x = \rho a(V-u)^2 \sin^2\theta$$

Where a = area of jet, V = velocity of jet and θ = inclination of plate with jet.

b) With the help of a neat diagram, explain the construction and working of a Pelton turbine. **(05)**

c) In which type of turbines draft tubes are required? Mention functions of draft tube. **(04)**

Q.2 **a)** Derive an expression for force exerted on a stationary symmetrical curved plate when the jet strikes at the center. **(05)**

b) A jet of water 60 mm in diameter, strikes a curved vane at its center with a velocity of 18 m/s. The curved vane is moving with a velocity of 6 m/s in the direction of the jet. The jet is deflected through an angle of 165°. Assuming the plate to be smooth, find: **(08)**

i) Thrust on the plate in the direction of jet
ii) Power of the jet
iii) Efficiency of the jet

Q.3 **a)** Derive an expression for maximum hydraulic efficiency of a Pelton turbine. **(05)**

b) A Pelton turbine having mean bucket diameter of 1 m is running at 1000 rpm. The net head on the Pelton turbine is 700 m. If the side clearance angle is 15° and discharge through the nozzle is $0.1 m^3/s$, determine power available at the nozzle and hydraulic efficiency of the turbine. **(08)**

Q.4 **a)** What are the Tubular or Bulb turbines? **(05)**

b) A Francis turbine with an overall efficiency of 75% is required to produce 149.26 kW. It is working under a head of 7.62 m. The peripheral velocity = $0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is = $0.96\sqrt{2gH}$. The wheel runs at 150 rpm and the hydraulic losses in turbine are 22% of the available energy. Assuming radial discharge, determine: **(08)**

i) Guide blade angle
ii) Vane angle at inlet
iii) Diameter of wheel at inlet

P.T.O.

SECTION-II

Q.5 **a)** What are the factors to be considered for selection of water turbines? **(05)**

b) Derive an expression for the minimum speed for starting a centrifugal pump. **(05)**

c) With the help of a neat sketch explain operation of hydraulic ram. **(04)**

Q.6 **a)** Explain various types of surge tanks used in water turbines. **(05)**

b) A Pelton wheel generates 8000 kW under a net head of 130 m at speed of 200 rpm. Assuming the coefficient of velocity for the nozzle = 0.98, hydraulic efficiency = 0.87, speed ratio = 0.46 and jet diameter to wheel diameter = 1/9, **(08)**

Determine:

i) Discharge required ii) Diameter of the wheel

iii) Diameter and number of jets required and iv) Specific speed

Mechanical efficiency is 75%.

Q.7 **a)** How cavitation occurs in centrifugal pumps? What are the effects of cavitation? State Thoma's cavitation factor for pumps. **(05)**

b) A centrifugal pump impeller has diameters at inlet and outlet as 360 mm and 720 mm respectively. The flow velocity at outlet is 2.4 m/s and the vanes are set back at an angle of 45° at the outlet. If manometric efficiency is 70%, calculate the minimum starting speed of the pump. **(08)**

Q.8 **a)** With the help of a neat sketch explain the operation of fluid coupling. Also explain a typical efficiency versus speed ratio curve for a fluid coupling. **(07)**

b) With the help of a neat sketch explain construction, working and efficiency of hydraulic ram. **(06)**

With the help of a graphical representation, show working cycle of a hydraulic ram.

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