B.TECH SEM – VI (2007 COURSE) (MECHANICAL ENGG.)

: WINTER - 2017

SUBJECT: FLUID MACHINERY

Day: **Thursday** Time: **10.00 AM TO 01.00 PM**

Date: **23/11/2017** **W-2017-2527** Max Marks: 80

N.B:

1) **Q. 1** and **Q. 5** are **COMPULSORY.**
2) Solve any **TWO** questions between **Q. 2** to **Q. 4** and **Q. 6** to **Q.8.**
3) Figures to the right indicate **FULL** marks.
4) Assume suitable data if necessary.

SECTION-I

Q. 1 **a)** Show that maximum efficiency of a free jet striking a symmetrical moving semicircular curved vane at the centre is slightly less than 60%. **(05)**

b) Explain briefly the principles on which Francis turbine works. **(05)**

c) Explain various components and constructional features of a Pelton wheel. **(04)**

Q. 2 **a)** A jet of water moving at 20 m/s impinges on a symmetrical curved vane shaped to deflect the jet through 120°. If the vane is moving at 5 m/s, find the angle of jet so that there is no shock at inlet. Also determine absolute velocity of exit in magnitude and direction, and the work done. **(08)**

b) Draw velocity triangles for a moving curved vane mounted radially on a wheel and also derive an expression for torque exerted on it. **(05)**

Q.3 **a)** A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 liters per second under a head of 35 m. If the bucket defects the jet through an angle of 160°, find the power developed by the turbine & the hydraulic efficiency. Take the coefficient of velocity at 0.98. Neglect friction in the bucket. Also determine overall efficiency of the turbine if its mechanical efficiency is 80%. **(08)**

b) Draw a neat sketch of bucket of a Pelton wheel, give its constructional features and also draw inlet and outlet velocity triangles for a Pelton wheel. **(05)**

Q.4 An inward radial flow reaction turbine with an overall efficiency of 80% is required to develop 150 kW. The head is 8 m, peripheral velocity of the wheel is $0.96\sqrt{2gH}$ the radial velocity of the flow is $0.36\sqrt{2gH}$. The wheel is to make 150 rpm, and the hydraulic losses in the turbine are 22% of the available energy. Determine: **(13)**

i) The angle of guile blade at inlet
ii) The wheel vane angle at inlet
iii) The diameter of the wheel.
iv) The width of the wheel at inlet.

P.T.O.

SECTION-II

Q.5 **a)** With the help of neat sketch, explain governing mechanism of a Pelton wheel. **(05)**

b) Explain various losses occurring during operation of a centrifugal pump. **(05)**

c) With the help of a neat sketch, explain working of an air lift pump. **(04)**

Q.6 **a)** What are the characteristic curves of a hydraulic turbine? How are they useful to practical engineer? Explain iso-efficiency curves with the help of neat sketches. **(08)**

b) With the help of neat sketch, explain the function of a relief valve in a water turbine. **(05)**

Q.7 A centrifugal pump lifts water against a static head of 40 m, of which 4 m is suction lift. The suction and delivery pipes are both of 150 mm diameters; the head loss in the suction pipe is 2.3 m and in the delivery pipe, 7.4 m. The impeller is of 420 mm diameter and 25 mm wise at the mouth; it revolves at 1200 rpm and its effective vane angle at exit is 35°. If the $\eta_{mano} = 82\%$ and $\eta_o = 72\%$, determine the discharge delivered by the pump and power required to drive the pump. Also find the pressure head indicated at the suction and delivery branches of the pump. **(13)**

Q.8 **a)** With the help of a neat sketch explain working of a hydraulic ram. **(08)**

b) With the help of a neat sketch explain the operation a torque converter. **(05)**

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