

Code No: RR310302

RR

Set No. 2

III B.Tech I Semester Examinations, November 2010

HYDRAULIC MACHINERY AND SYSTEMS

Common to Mechanical Engineering, Automobile Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. (a) What are the hydraulic losses associated with centrifugal pumps?
 (b) The discharge of a centrifugal pump is $0.38 \text{ m}^3 / \text{sec}$ and runs at a speed of 1500 rpm. The head developed is 15 m. The width of the impeller at outlet is 5 cm and the diameter is 75 cm. The manometric efficiency is 0.8. Estimate the blade angle at outlet [8+8].
2. (a) Obtain an expression for the force exerted by a jet of water on an unsymmetrical moving curved plate when the jet strikes tangentially at one of the lips. Sketch the velocity triangles at inlet and at outlet.
 (b) 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 the jet so that there is no shock at inlet. Also determine the absolute velocity at exit in magnitude and direction and the work done. [8+8]
3. (a) Why is Pelton wheel suitable for high heads only?
 (b) When are multijet Pelton wheels used?
 (c) What are the empirical rules adopted for the size of the buckets of a Pelton wheel?
 (d) How is the number of buckets for a Pelton wheel selected? [4+4+4+4]
4. (a) What is a Hydraulic accumulator? Discuss the merits and demerits of weight loaded and air-hydraulic accumulator.
 (b) Water is supplied to an accumulator at a pressure of 150 Kpa. The diameter of the ram is 2m and the lift is 10m. Determine the capacity of the accumulator and the total weight placed on the ram. [8+8]
5. (a) Show that for maximum power transmission the head lost due to friction is equal to one-third the head at inlet.
 (b) 100 h.p. is to be transmitted, the pressure at the inlet of the pipe being 70 kg/cm^2 . If the pressure drop per kilometer is 0.43 kg/cm^2 and if $f = 0.006$, find the diameter of the pipe and the efficiency of transmission for 16 kilometres. [8+8]
6. (a) What do you understand by multistage pump? When do you use them?
 (b) What do you understand by pumps in parallel? When do you connect the pumps in parallel? [8+8]

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7. A hydroelectric power station requires a turbine producing 3MW at 250 rpm under a head of 25m. Calculate the specific speed of the turbine. Estimate the runner diameter if the speed ratio is 0.70 and suggest the type of the turbine and runner. [16]
8. (a) Define; slip, percentage slip, negative slip and coefficient of discharge of reciprocating pump,
- (b) The diameter and stroke length of a single action reciprocating pump are 100 mm and 300mm respectively. The water is lifted to a height of 20 m above the center of the pump. Find the maximum speed at which the pump may be run so that no separation occurs during the delivery stroke if the diameter and length of delivery pipe are 50 mm and 25 m respectively. Separation occurs if the absolute pressure head in the cylinder during delivery stroke falls below 2.50m of water. Take atmospheric pressure head = 10.3 m of water. Take $f=0.018$. [8+8]

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(b) The discharge of a centrifugal pump is $0.38 \text{ m}^3 / \text{sec}$ and runs at a speed of 1500 rpm. The head developed is 15 m. The width of the impeller at out let is 5 cm and the diameter is 75 cm. The manometric efficiency is 0.8. Estimate the blade angle at outlet [8+8].
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6. (a) Define; slip, percentage slip, negative slip and coefficient of discharge of reciprocating pump,
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length of delivery pipe are 50 mm and 25 m respectively. Separation occurs if the absolute pressure head in the cylinder during delivery stroke falls below 2.50m of water. Take atmospheric pressure head = 10.3 m of water. Take $f=0.018$. [8+8]

7. (a) Show that for maximum power transmission the head lost due to friction is equal to one-third the head at inlet.
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8. A hydroelectric power station requires a turbine producing 3MW at 250 rpm under a head of 25m. Calculate the specific speed of the turbine. Estimate the runner diameter if the speed ratio is 0.70 and suggest the type of the turbine and runner. [16]

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RR**Set No. 3****III B.Tech I Semester Examinations, November 2010****HYDRAULIC MACHINERY AND SYSTEMS****Common to Mechanical Engineering, Automobile Engineering****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

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