B.E.(with Credits)-Regular-Semester 2012 - Mechanical Engineering Sem IV

ME405 - Hydraulic Machines

P. Pages : 2 **GUG/W/16/3924**

Time : Three Hours * 4 0 3 9 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

1. a) What are the various assumptions made in the derivation of expression for the force exerted by a jet of fluid on a stationary flat plate. **6**

b) Show that the angle of swing for a flat plate hinged at the top, when the jet strikes normal to the plate at the centre is given by **10**

$$\sin\theta = \frac{PAV^2}{W}$$

where, θ = angle of swing
P = density of fluid
A = area of flat plate
V = Velocity of the jet
W = Weight of the plate

OR

2. a) Derive expressions for The force exerted by the jet of water on a pelton wheel in the direction of the jet, work done per second & the hydraulic efficiency of the pelton wheel. **11**

b) Explain the characteristic features of the cup of a pelton wheel. What are the limitations in keeping the deflective angle of the cup as 180º ? **5**

3. a) Differentiate clearly between Francis Turbine and Kaplan Turbine. **7**

b) The following data refers to the runner of a Kaplan Turbine? Which yields 8850kW at the Turbine shaft: **9**

Net available head = 5.5 m,
Speed Ratio = 2.1:1
flow Ratio = 0.67:1
Overall efficiency = 85%

Presuming that hub diameter of the wheel is 0.35 times the outside diameter, find the runner diameter and its rotational speed.

OR

4. a) Explain the theory of Draft Tube. **6**

b) A Francis Turbine develops 365kW at an overall efficiency of 80%, when working under a static head of 5m; the draft tube being cylindrical and of diameter 2.5m. What increase in power and efficiency of the turbine would you expect, if a tapered draft tube having an inlet diameter of 4 m and the efficiency of conversion of 90%, is substituted for the cylindrical one. It may be presumed that the head, speed and the discharge remain constant. **10**

5. a) Derive an expression for the specific speed of a Pelton Turbine. **5**

b) A Turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m^3/s of the turbine efficiency is 90% determine: **11**
i) Sp. Speed of the turbine.
ii) Power generated
iii) Performance under a head of 20m.
Also state the type of the turbine.

OR

6. a) What is governing of a Turbine? **6**

b) Explain the construction and working of governing mechanism of a Reaction Turbine. **10**

7. a) How will you classify pumps? **5**

b) Derive an expression for the work done by the impeller of a Centrifugal pump on a liquid. **11**

OR

8. a) What do you understand by a positive displacement pump? **4**

b) A single acting reciprocating piston pump running at 50 rpm delivers 7.36 litres/s of water. The diameter of the piston is 20 cm and the stroke is 30 cm. The suction and delivery heads are 3.5 m and 11.5 m respectively. Determine: **12**
i) Theoretical Discharge,
ii) Coefficient of discharge,
iii) Percentage slip of the pump, &
iv) Power required to run the pump.

9. a) Explain the construction and working of a hydraulic Ram. **8**

b) Derive an expression for the discharge of a viscous fluid through a gear pump. **8**

OR

10. Write short notes on **any four.** **16**
a) Air Vessels,
b) Specific Quantities,
c) Unit Quantities,
d) Model Testing of a Centrifugal Pump,
e) Air – Lift pump.

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