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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, November/December-2013
Fluid Mechanics and Hydraulic Machinery
(Electrical and Electronics Engineering)

Time: 3 hours   Max. Marks: 75

Answer any five questions
All questions carry equal marks

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1.a) What is the difference between dynamic viscosity and kinematic viscosity? On what factors does the viscosity depend?

 b) Two horizontal flat plates are placed 0.15 mm apart and the space between them is filled with an oil of viscosity 1poise. The upper plate of area 1.5 m^2 is required to move with a speed of 0.5 m/s relative to the lower plate. Determine the necessary force and power required to maintain this speed.   [15]

2.a) Define path line, streak line and stream line. For what type of flow these lines are identical?

 b) Water flow through a pipe sloping so that centerline of the pipe at exit is 2 m above its center line at inlet. The pipe diameters at inlet and exit sections are 10 cm and 5 cm respectively. Measurements show that when the water flow rate is 2 m^3/min, the pressure at the inlet section is 315 kN/m^2 and the total head loss up to the section is 1.5 m of water flowing. Estimate the pressure at exit if the gravitational acceleration at the location is 9.5 m/s^2.   [15]

3.a) Derive Darcy-Weisbach formula for calculating loss of head due to friction in a pipe.

 b) A horizontal venturimeter 300 mm × 150 mm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 0.5 m^3/s. Find the reading of oil-mercury differential manometer. Take venturimeter constant = 0.98.   [15]

4.a) Derive an expression for the force exerted by a jet of water on moving inclined plate in the direction of jet.

 b) A jet strikes tangentially a smooth curved vane moving in the same direction as the jet, and the jet gets reversed in the direction. Show that maximum efficiency is slightly less than 60 per cent.   [15]

5.a) What do you understand by pumped storage plant? What are the advantages and disadvantages of his power plant?

 b) A medium type storage type hydro electric power plant covers 1200 Km^2 area. The annual rain fall in catchment area is 160 cm. The head available at the power plant site is 360 m. Assuming 25 % rain fall is lost in evaporation. Find the average power developed by the power plant and maximum demand, when overall efficiency is 75% and load factor is 0.5.   [15]

6.a) Prove that the work done per second per unit weight of water in a reaction turbine as $1/g$ ($Vw_1u_1\pm Vw_2u_2$)

b) Design a pelton wheel for a head of 80 m and speed 300 rpm. The pelton wheel develops 103 KW S.P. Take $Cv = 0.98$, speed ratio $= 0.45$ and overall efficiency $= 0.80$. [15]

7.a) What is cavitation? How can it avoided in reaction turbine?

b) A Pelton wheel is revolving at a speed of 200 pm and develops 5900 KW S.P when working under a head of 200m. With an overall efficiency of 80%. Determine unit speed, Unit discharge and Unit power? The speed ratio of the turbine is given as 0.48. Find the speed, discharge, and power when this turbine is working under a head of 150 m. [15]

8.a) Why are centrifugal pumps used some times in series and sometimes in parallel?

b) A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 30^0 of velocity of flow at outlet is 3 m/s. The pump is working against the total head of 30 m, and the discharge through the pump is 0.3 m^3/s. If the manometric efficiency of the pump is 75%. Determine the diameter of the impeller and width of the impeller at outlet. [15]

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