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FOURTH SEMESTER B.TECH. DEGREE EXAMINATION - MAY 2013

ME09 405 – FLUID MACHINERY

Time: 3 hours **Maximum : 70 marks**

Part A

(Answer all questions. Each question carries 2 marks)

1. State and explain impulse momentum equation
2. Differentiate between dynamic force and hydrostatic pressure
3. Write down the functions of draft tube
4. What is meant by manometric efficiency of centrifugal pump?
5. Define slip in reciprocating pumps

(5 x 2 = 10 Marks)

PART B

(Answer any Four question. Each question carries 5 marks)

6. Show that when a jet of water impinges on a series of plate on wheel the maximum efficiency is 50%

7. Find the expression for propelling force and work done per second on a tank which is provided with an orifice through which jet of water is coming out and tank is force to move

8. Explain the cavitation phenomena in turbines

9. Derive the equation for specific speed of turbines

10. Derive an equation for minimum speed for starting a centrifugal pump

11. Explain the functions of air vessels in reciprocating pumps

(4 x 5 = 20 Marks)

PART C

(Answer Section (a) Or Section (b) of each question. Each question carries 10 marks)

12. (a) The water in a jet propelled boat is drawn amid ship and discharged at the back with an absolute velocity of 20 m/s. The cross sectional area of the jet at the back is 0.02 m2 and the boat is moving with a speed of 30km/hour. Determine (i) propelling force on the boat (ii) power required to drive the pump (iii) efficiency of jet propulsion

Or

(b) A 7.5 cm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 450 to the axis of the jet. Find the normal pressure on the plate (i) when the plate is stationary (ii) when the plate is moving with a velocity of 15 m/s and away from the jet. Also determine the power and efficiency of the jet when the plate is moving

13. (a) A Pelton wheel is working under a head of 400m. The water is supplied through a penstock of dia. 1m and length 4km from the reservoir to the Pelton wheel. The coefficient of friction for the penstock is given as 0.008.The jet of water of dia. 150 mm strikes the buckets of the wheel and gets deflected through an angle of 1650. The relative efficiency of water at outlet is reduced by 15% due to friction between inside surface of the bucket and water. If the velocity of the bucket is 0.45 times the jet velocity at inlet and mechanical efficiency as 85% Determine (i) power given to the runner (ii) shaft power (iii) Hydraulic efficiency and overall efficiency.

Or

(b) An inward flow reaction turbine has external and internal diameters as 1m and 0.6m respectively. The hydraulic efficiency of the turbine is 90% when the head on the turbine is 36m. The velocity of flow at outlet is 2.5 m/s and the discharge at outlet is radial. If the vane angle at outlet is 15⁰ and width of the wheel is 100mm at inlet and outlet. Determine (i) guide blade angle (ii) speed of turbine (iii) vane angle of runner at inlet (iv) volume flow rate of turbine (v) power developed

14. (a) The internal and external diameters of an impeller of a centrifugal pump which is running at 1000 rpm are 200 mm and 400 mm respectively. The discharge through the pump is 0.04m³/s and the velocity of flow is constant and equal to 2 m/s. The diameters of suction and delivery pipes are 150 mm and 100 mm respectively and suction and delivery heads are 6 m (abs) and 30 m (abs) of water respectively. If the outlet vane angle is 45⁰ and power required to drive pump is 16.186 kW, determine (i)vane angle of the impeller at inlet (ii) the overall efficiency (iii) manometric efficiency

Or

(b) A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 45⁰ and velocity of flow at outlet is 2.5 m/s. The discharge through the pump is 200litres/s when the pump is working against a total head of 20 m. If the manometric efficiency of the pump is 80% determine (i) outside diameter of the impeller (ii) width of the impeller at outlet

15. (a) Describe the working of reciprocating pump with neat sketch. Explain the effect of friction and effect of acceleration on separate as well as combined indicator diagrams of a reciprocating pump

Or

(b) Sketch and explain the working of (i) gear pump and (ii) screw pump

(4 x 10 Marks = 40 Marks)

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