

Name :

Reg. No:

FOURTH SEMESTER B.TECH (ENGINEERING) DEGREE EXAMINATION MAY 2012**ME 09 405 FLUID MACHINERY**

Time: Three Hours

Maximum: 70 Marks

PART-A (Answer All Questions)**(5×2 =10 Marks)**

1. Define: Impact of jet and jet propulsion.
2. What do you mean by dimensionless numbers? Name any four dimensionless numbers.
3. According to the principle, direction of fluid flow, specific speed and suitability list out the differences between Pelton, Francis and Kaplan turbines.
4. What is net or effective head?
5. What is a positive displacement pumps?

PART-B (Answer any Four Questions)**(4×5 =20 Marks)**

1. Derive the expressions for force and work done per second by the jet when it strikes a flat vertical plate moving in the direction of the jet and away from the jet.
2. Explain Buckingham's π -theorem. What do you mean by repeating variables? How are the repeating variables selected in dimensional analysis?
3. Distinguish between reaction turbine and impulse turbine.
4. Explain the effect of blade angle on pump head.
5. What is a positive displacement pumps? How does it differ from a turbo pump in its basic principle of operation?
6. Explain the construction and working of Hydraulic accumulator with a neat sketch.

PART-C**(4×10 =40 Marks)**

1. A 10cm diameter jet of water exerts a force of 2 kN in the direction of flow against a stationary flat plate which is inclined at an angle of 30° with the axis of the stream. Find
 - i. Force normal to the plate
 - ii. Velocity of the jet
 - iii. Mass flow rate of water kg/s.

(OR)

2. The drag force F on a partially submerged body depends on the relative velocity V between the body and fluid, characteristic linear dimension ' l ', height of the linear surface roughness k , fluid density ρ , the viscosity μ , and acceleration due to gravity g . Obtain an expression for the drag force, using the method of dimensional analysis.

$$F = \rho l^2 V^2 \phi \left(\frac{\mu}{\rho V l}, \frac{lg}{V^2}, \frac{k}{l} \right)$$

3. A Pelton wheel turbine develops 9000 kW under a head of 300m. The turbine speed is 550 rpm and ratio of jet dia to wheel dia is 1/10. The hydraulic, volumetric and mechanical efficiencies are 0.98, 0.95 and 0.92 respectively. The speed ratio is 0.46 and coefficient of velocity is 0.98. Calculate the no of jets to be provided.

(OR)

4. An inward flow reaction turbine has inlet and outlet diameters of 1.2 m and 0.6 m respectively. The breadth at inlet is 0.25 m and at outlet it is 0.35m. The runner speed is 250 rpm. The relative velocity at inlet is 3.5 m/s and is radial. Determine
- the absolute velocity at inlet and its inclination to the tangent of runner
 - Discharge and
 - The velocity of flow at outlet.

5. Derive the equation for work done by the impeller of a centrifugal pump on the fluid handled. What are different efficiencies of centrifugal pump?

(OR)

6. A three stage centrifugal pump has impellers 400 mm in diameter and 20 mm wide at outlet. The vanes are curved backward at the outlet at 45° and reduces the circumferential area by 10 percent: the monometric efficiency is 90% and the overall efficiency is 80% the pump is running at 1000 rpm and delivering $0.05\text{m}^3/\text{s}$. Determine the following.
- Head generated by the pump and
 - Shaft power required to run the pump

7. A single-acting reciprocating pump running at 30 rpm, delivers $0.012\text{ m}^3/\text{s}$ of water. The diameter of the piston is 25 cm and stroke length 50 cm. Determine:
- The theoretical discharge of the pump
 - Co-efficient of discharge, and
 - Slip and percentage slip of the pump.

(OR)

8. i) Explain the construction and working of jet pump with a neat sketch and also explain the jet pump efficiency and its usage.
ii) Explain the construction and working of a Hydraulic ram with a neat sketch.