

[03 - 4117]

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

FLUID MACHINERY AND SYSTEMS

(Common with Dual Degree Programme in Mechanical Engineering)

(Effective from the admitted batch of 2006-2007)

Time : Three hours

Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

Answer to question No.1 must be at one place.

1. (a) Write short notes on Jet Propulsion. ($7 \times 2 = 14$)
- (b) How will you classify the turbines?
- (c) Define the terms:
Flow ratio and jet ratio
- (d) Differentiate between an inward and outward flow reaction turbine.

- (b) Find the power required to drive a double acting pump and the quantity of water delivered per hour under the following conditions :

Head of water excluding friction = 16 m,

Diameter of main = 1 m,

Length of main = 2000 m,

Diameter of cylinder 0.75 m,

Speed of pump = 24 r.p.m.

Length of stroke = 1.5 m,

Positive slip = 4%

Mechanical efficiency = 80%

Assume f = 0.01
(7)

8. (a) Describe with the help of a neat sketch the working of a hydraulic accumulator. (7)

- (b) An accumulator has ram 0.3 m in diameter and a lift of 7.5 m. Water is supplied at a pressure of 5900 kN/m^2 . Find the necessary load on the ram and the capacity of the accumulator in kilowatt hours. (7)
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- (e) How will you prevent the cavitation in hydraulic machines?
- (f) How will you classify the reciprocating.
- (g) Explain the term hydraulic devices. Name any four hydraulic devices.
2. (a) Show that the efficiency of a free jet striking normally as series of flat plates mounted on the periphery of a wheel never exceeds 50%. (7)
- (b) A metal plate of 10 mm thickness and 200 mm square is hung so that it can swing freely about the upper horizontal edge. A horizontal jet of water of 20 mm diameter impinges with its axis perpendicular and 50 mm below the edge of the hinge and keeps it steadily inclined at 30° to vertical. Find the velocity of the jet, if the specific weight of the metal is 75.54 kN/m^3 . (7)
3. A jet of water having a velocity of 60 m/sec impinges without shock on a series of vanes moving at 30 m/sec. The direction of motion of vanes being inclined at 20° to that of the jet. The angle between the inlet and outlet relative velocity is 120° and the ratio between these velocities is 0.9. Determine :
- (a) The angle ' θ ' at the entry edge of the vane.
- (b) The work done by the vanes
- (c) Hydraulic efficiency. (14)

4. (a) A Francis turbine runner having a diameter of 2.92 m operates at 163.5 r.p.m., Under 54 m head and develops 19900 kw at an efficiency of 87%. Find the other characteristics if this turbine operated under 60 m head. (9)
- (b) An impulse turbine at best speed produces 92 kw. Under a head of 63 m. By what percent should the speed be increased for a head of 87 m? (5)
5. (a) Explain the working principles of reciprocating Pump with sketches. (7)
- (b) Explain the functions of air vessels in a reciprocating Pump. (7)
6. (a) Explain with neat sketches the working of a single stage centrifugal pump. (5)
- (b) A centrifugal pump of the radial type delivers 5000 litres per minute against a total head of 38 m, when running at a speed of 1450 r.p.m. If the outer diameter of the impeller is 300 mm and its width at the outer periphery is 13 mm. Find the vane angle at exit. Assume manometric efficiency as 80%. (9)
7. (a) A single acting reciprocating pump has a diameter 0.3 m and a stroke length of 0.4 m. If the speed of the pump is 60 r.p.m. and co-efficient of discharge is 0.97. determine the percentage slip and actual discharge the percentage slip and actual discharge of the pump. (7)