B.Tech. Degree IV Semester (Supplementary) Examination January 2011

ME 405 HYDRAULIC MACHINERY

(2006 Scheme)

Time : 3 Hours | Maximum Marks : 100

PART - A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I.
(a) Write steps in Reyleigh method for dimensional analysis. What are its limitations?
(b) What is dynamic force? How it differ from Hydro static pressure force?
(c) Differentiate between impulse turbine and reaction turbine.
(d) What is cavitation?
(e) Explain the methods of speed regulation of turbines.
(f) Explain working of multistage pumps. What are the advantages of this type of pumps?
(g) With neat sketch explain working of a gear pump.
(h) Explain working of Hydraulic Ram.

PART – B

(4 x 15 = 60)

II. A jet of water 7.5 cm in diameter and having a velocity of 15 m/s strikes a fixed plate in such a way that the angle between the jet and the plate is 40°. Find :

(i) Max force of the jet on the plate
(ii) Force in the direction of jet
(iii) Force normal to the jet direction. (15)

OR

III. The diameter and width of the runner of a turbine are D and B respectively and it rotates at speed N. The working head is H. If density and viscosity of the working fluid be ρ and μ respectively, show that the power developed will be given by $P = \rho N^3 D^5 f\left(\frac{B}{D}, \frac{ND}{\sqrt{gH}}, \text{Re}\right)$. (15)

IV. An inward flow reaction turbine of inlet diameter 1.2 m operates under a head of 150 m and requires a discharge of 6 m^3/s at a rotational speed of 400 r.p.m. The guide vane angle is 20° and the water leaves the runner blade radially. If the runner is 10 cm wide at the inlet, calculate :

(i) The torque and power applied to the shaft
(ii) The turbine efficiency (15)

OR

V. A Kaplan turbine operating under a net head of 20 m develops 36750 KW with an overall efficiency of 86%. The speed ratio is 2 and the flow ratio is 0.69. The hub diameter of the wheel is 0.35 times the outside diameter of the wheel. Find the diameter and speed of the turbine. (15)

VI. A centrifugal pump impeller is 40 cm in outside diameter and 2.5 cm wide at exit and its blade angle is 150° when run at a speed of 2100 rpm, the flow rate through the pump is 80 liters/sec.

(a) Calculate :

(i) radial

(ii) relative and absolute fluid velocities at the impeller exit.

(b) If there is no inlet whirl what would be the head added to the water by the impeller? (15)

OR

VII. A single acting reciprocating pump has vertical suction pipe 2.5 m long having 5 cm diameter. The stroke of the plunger is 30 cm and its diameter 15 cm. At what maximum speed should the pump run to avoid cavitation at the suction valve when pumping water? The barometric pressure head is 10.3 m of water. Pressure required to force suction valve open is 2943 N/m^2 and cavitation occurs at the beginning of the stroke at 1.8 m of water absolute. (15)

VIII. (a) With the help of sketch explain working of a torque converter. (8)

(b) Differentiate between axial and radial pumps. (7)

OR

IX. (a) With the help of sketch explain the working of a Hydraulic Intensifier. (8)

(b) What is a Hydraulic Accumulator? Where it is used? (7)

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