Printed Pages: 2
Paper Id: 1 4 0 6 1 2

Sub Code: NME021
Roll No.

B.TECH
(SEM VI) THEORY EXAMINATION 2017-18
FLUID MACHINERY

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. What are Fluid machines or Hydraulic machines?
b. State the function of breaking jet in Pelton wheel turbine.
c. Why spiral casing of varying area is employed in reaction turbine?
d. What are the function of Draft tube?
e. What is meant by cavitation with reference to reaction turbine?
f. Differentiate between volute and vortex casing of a centrifugal pump.
g. What is meant by manometric head for centrifugal pump?
h. What is NPSH?
i. What is meant by positive displacement pump?
j. Define the term SLIP of Reciprocating pump.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Derive moment of momentum equation. Also explain its significance
b. Discuss the characteristic curves of hydraulic turbines in detail.
c. A Kaplan turbine develops 9000 KW under a net head of 7.5m. Overall efficiency of the turbine is 86%. The speed ratio based on the outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of runner and the specific speed of the runner.
d. A centrifugal pump discharges 5 m^3/s under a head of 130 m running at 600 rpm. Outer diameter of impeller is 2 m and has a positive suction lift of 3.2 m including velocity head and friction losses in suction pipe. Experiments were conducted on a geometrically similar model of 0.4 m outer diameter of impeller under a head of 90 m. Vapour pressure of liquid is equal 0.35 m of head. Calculate the discharge, speed and suction lift for the model. Assume atmospheric pressure head = 10.2 m of water.
e. With a neat sketch, write down short notes on air lift pump.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) 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, and
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

(b) What do you understand by term governing of turbine? Explain governing mechanism for Pelton wheel.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Discuss the various characteristic curves of hydraulic turbines in detail.

(b) A reaction turbine is revolving at a speed of 200 R.P.M. and develops 5886 kW S.P. when working under a head of 200 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio for the turbine is given as 0.48. Find the speed, Discharge and Power when this turbine is working under a head of 150 m.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Classify Hydraulic turbines in detail.

(b) Determine the overall efficiency of a Kaplan turbine developing 2850 kW under a head of 5.2 m. It is provided with a draft tube with its inlet (diameter 3m) set 1.8 m above the tail race level. A vacuum gauge connected to the draft tube indicates a reading of 5.2 m of water. Assume draft tube efficiency as 75%.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) A centrifugal pump with 1.2 m diameter runs at 200 rpm and discharges 1900 liters water per second, the average lift being 6 m. The angle which the vanes make at exit with the tangent to the impeller is 26° and the radial velocity of flow is 2.5 m/s. The inner diameter of the impeller is 0.6 m.
Determine: The power required to drive the pump, the manometric efficiency and the minimum rpm to start pumping against a head of 6 m.

(b) What is priming in centrifugal pump? Why it is done? What is self-priming pump? Explain.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) What do you understand by an indicator diagram? Explain ideal indicator diagram.

(b) A single acting reciprocating pump of 12 cm diameter and 24 cm stroke is delivering water to the tank which is 10 m above the center of pump. The pump is located 5 m above the center of sump. The diameter and the length of the suction pipe are 5 cm and 5 m respectively, and diameter and length of delivery pipe are 4 cm and 20 m respectively. Find the maximum speed of the pump to avoid separation either in suction pipe or delivery pipe. Take atmospheric pressure head 10.33 m of water and separation occurs at 80 kN/m^2 below atmospheric pressure.