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B. TECH.
(SEM.IV) 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.
2. Be precise in your answer. Draw neat diagrams wherever necessary.

SECTION A

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

(a) Explain the momentum equation.
(b) Differentiate between impulse turbine and a reaction turbine?
(c) What is the main difference between radial and axial flow turbines
(d) What is the function of nozzle in an impulse turbine?
(e) What are the main advantages of model testing?
(f) List the characteristic curves of Hydraulic turbine.
(g) Explain the significance of whirl velocity component of absolute velocity.
(h) Write down the advantages of multistaging in centrifugal pump.
(i) Why spiral casing of varying area is employed in reaction turbine.
(j) Explain hydroelectric power plant with the help of neat sketch.

SECTION B

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

(a) What do you mean by impact of jet? With the help of neat sketch derive an expression for the force exerted by fluid jet on a stationary inclined plate.
(b) Define and derive expressions for unit speed, unit power and unit discharge as used in connection with operation hydraulic turbines.
(c) Explain different heads and efficiencies of centrifugal pump in details.
(d) Derive an expression for pressure head due to acceleration of the piston of a reciprocating pump. Show the effect of acceleration on the indicator diagram.
(e) What is function of hydraulic press? Describe with the help of a neat sketch its constructional features and working. Discuss its characteristics. State its merits, limitations and applications.

SECTION C

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

(a) Explain gross head, effective head (net head), hydraulic, mechanical, and overall efficiencies of a Pelton turbine.
(b) A jet of water having a velocity of 15 m/s strikes a curved vane which is moving with a velocity of 5 m/s. The vane is symmetrical and it so shaped that the jet is deflected through 120^0. Draw the velocity triangles at inlet and outlet and find the angle of the jet at inlet of the vane so that there is no shock. What is the absolute velocity of the jet at outlet in magnitude and direction and the work done per unit weight of water? Assume the vane to be smooth.

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

(a) What is a draft tube? State the functions of a draft tube. Give the classification of draft tube. How is efficiency of a draft tube defined?

(b) A Kaplan turbine develops 20 MW when running at 130 rpm under a head of 20 m. The outer diameter of the runner is 4 m and hub diameter is 1.8 m. The hydraulic and overall efficiency of the turbine are 90% and 85% respectively. Determine the discharge through the turbine and the blade angles at inlet and outlet, measured at mean radius of the runner.

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

(a) Derive the expression for work done by the centrifugal pump (impeller) on water. What are the advantages of centrifugal pumps over reciprocating pumps?

(b) A centrifugal pump impeller runs at 80 rpm and has outlet vane angle of 60^0. The velocity of flow is 2.5 m/s throughout the diameter of the impeller at exit is twice that at inlet. If manometric head is 20 m and manometric efficiency is 75%, determine:

(i) The diameter of the impeller at the exit,

(ii) Inlet

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

(a) Show that work saved in overcoming friction in pipelines by fitting air vessels in a reciprocating pump is 39.2% for double acting pump.

(b) Explain with the help of delivery curves, how the resultant rate of discharge can be made uniform in different types of reciprocating pumps.

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

(a) What is function of torque converter? Describe with the help of a neat sketch its constructional features and working. Discuss its characteristics. State its merits, limitations and applications.

(b) Explain the function, construction and operation of air lift pumps. State its merits, limitations and applications.