

W432

B. Tech. (Weekend) EXAMINATION, 2020

(Fourth Semester)

(Fluid Machines)

ME(W)204

ME

Time : 3 Hours]

[Maximum Marks : 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt any *Five* questions.

1. A jet of water is moving at 60 m/s and is deflected by a vane moving 25 m/s in a direction at 30° to the direction of the jet. The water leaves the blades with no velocity component in the direction of motion of vane. Determine the inlet and outlet angles of the vanes for no shock at entry or exit. Assume outlet velocity of water relative to the blades to be 0.85 of the relative velocity at entry. **20**
2. The jet of water coming out of nozzle strikes the buckets of a Pelton wheel which when stationary would deflect the jet through 165° . The velocity of water at exit is 0.9 times at the inlet and the bucket speed is 0.45 times the jet speed. If the speed of the Pelton wheel is 300 rpm and the effective head is 150 m, determine : **20**
 - (i) Hydraulic efficiency, and
 - (ii) Diameter of the Pelton wheel.Take co-efficient of velocity $c_v = 0.98$.

3. (a) Draw a schematic diagram of a Francis turbine and explain its construction and working. **10**
- (b) For a typical Francis turbine vane, show the inlet and outlet velocity diagrams and label the different velocity elements in the diagram. **10**
4. (a) Discuss the construction and operations of a Kaplan Turbine. **10**
- (b) What are the differences between Kaplan and Francis Turbine ? Also discuss how they differ in terms of their Specific Speed ? **10**
5. (a) Define the term cavitation in hydraulic systems. What are its harmful effects ? Discuss methods to prevent cavitation. **10**
- (b) Discuss the difference between Model and Similitude. Discuss the significance of dimensionless numbers in the design and testing of hydraulic systems. **10**
6. (a) What is meant by priming of a centrifugal pump ? Why is it necessary ? What are the arrangements employed for priming of centrifugal pump ? **5**
- (b) A centrifugal pump of 250 mm diameter runs at 1450 rpm and delivers $0.35 \text{ m}^3/\text{sec}$ against a head of 14 m. Calculate the specific speed of the pump. A similar pump with half the size is to run at a head of 11 m. Find the working speed, discharge and power required assuming efficiency of the pumps to be 78%. **15**
7. (a) What is NPSH ? Discuss the significance of NPSH in pump settings. **5**
- (b) Discuss the utility of Air Vessels in reciprocating pump setups. Indicate how use of air vessel helps in the saving the energy in pumping systems. **15**
8. Briefly discuss the construction and operation of the following Hydraulic systems. Use sketches for illustration :
- (a) Torque Converters
- (b) Hydraulic Rams. **10×2=20**