

FLUID FACILITIES AND MACHINERY

GUIDE TO LABORATORY PRACTICALS

University of the Basque Country (UPV/EHU)

Energy Engineering Department

SELF – ASSESSMENT

THEME 4: TURBINES – FRANCIS TURBINE

1. A Francis turbine is:
 - a. An action turbine because the energy exchange takes place at atmospheric pressure.
 - b. An action turbine because part of the energy exchange is produced by the pressure variation existing between the inlet and outlet of the runner.
 - c. A reaction turbine because part of the energy exchange is produced by the pressure variation existing between the inlet and outlet of the runner.
 - d. A reaction turbine because the exchanged energy occurs at atmospheric pressure.

2. The main purpose of the injector of a Francis turbine is:
 - a. To direct the fluid towards the runner.
 - b. Francis turbines do not have injectors.
 - c. To shape the streamlines so that they run parallel to minimise energy losses.
 - d. To create a jet with an appropriate diameter for the runner blades.

3. At the optimum point of operation:
 - a. The mechanical power is maximum.
 - b. The torque is maximum.
 - c. The hydraulic power is maximum.
 - d. The efficiency is maximum.

4. The point of maximum performance:
 - a. Matches with the point of maximum mechanical power.
 - b. Matches with the maximum torque.
 - c. Matches with maximum hydraulic power.
 - d. None of the above.

5. In the conditions under which the Francis turbine described in the practice is operated, and regarding the hydraulic power:
 - a. At a constant head, it will increase as the flow rate decreases.
 - b. At a constant head, it will increase as the flow rate increases.
 - c. It will always depend on the degree of opening of the injector.
 - d. It only depends on the neat head.

6. In the conditions under which the Francis turbine described in the practice is operated, and regarding the torque:
- For a given opening degree of the distributor, it will be constant.
 - For a given opening degree of the distributor, its tendency is parabolic.
 - For a given opening degree of the distributor, it will increase with the rotational speed.
 - For a given opening degree of the distributor, it will decrease with the rotational speed.
7. In the conditions under which the Francis turbine described in the practice is operated, and regarding the mechanical power:
- It depends only on the torque.
 - It depends only on the position of the guide-vanes.
 - Its evolution follows a straight trend line.
 - At zero flow, its value is zero.
8. In the conditions under which the Francis turbine described in the practice is operated, and regarding the efficiency:
- It is the relation between the hydraulic power and the mechanical power.
 - At zero flow, its value is maximum.
 - Its maximum value corresponds to the optimum operating conditions.
 - Its evolution follows a straight trend line.