KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 314
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 16 AUG 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. How does the velocity of jet stream affect the impact force?
   a. Higher velocity increases the impact force
   b. Higher velocity decreases the impact force
   c. Velocity has no effect on the impact force
   d. The effect of velocity depends on the surface area

2. The efficiency of a Pelton turbine is maximum when the velocity of the bucket is:
   a. Equal to jet velocity
   b. Half the jet velocity
   c. One-third the jet velocity
   d. Double the jet velocity

3. Which of the following statement is **CORRECT**?
   a. In an impulse turbine, the water impinges on the buckets with pressure energy.
   b. In a reaction turbine, the water glides over the moving vanes with kinetic energy.
   c. In an impulse turbine, the pressure of the flowing water remains unchanged and is equal to atmospheric pressure.
   d. In a reaction turbine, the pressure of the flowing water increases after gliding over the vanes.

4. Which of the following is not a characteristics of Pelton turbines?
   a. High efficiency at high head
   b. Simple design
   c. Suitable for variable flow rates
   d. High efficiency at low head

5. What is the role of angle of impact in jet force calculations?
   a. It changes the velocity of the jet
   b. It affects the distribution of the impact force
   c. It determines the color of the jet
   d. It influences the temperature of the jet

6. The Francis turbine is named after which Engineer?
   a. James Francis
   b. Kaplan Francis
   c. Francis Drake
   d. Thomas Edison

7. The water jet strikes the bucket of a Pelton turbine at an angle of:
   a. 0°
   b. 30°
   c. 45°
   d. 90°

8. The main advantage of a Turgo Turbine is
   a. High efficiency at low heads
   b. High efficiency at high heads
   c. Simple construction
   d. Ability to handle large flow rates

9. What type of governor is typically used in Pelton turbines?
   a. Flywheel governor
   b. Centrifugal governor.
   c. Hydraulic governor
   d. Pneumatic governor

10. The force exerted by a jet on a curved vane is
   a. Always greater than the force on a flat plate
   b. Always less than the force on a flat plate
   c. Can be greater or less than the force on a flat plate, depending on the vane shape
   d. Independent of the vane shape

11. Which one of the following statements is not correct?
   a. Draft tubes decrease efficiency of a turbine.
   b. Wheels of a reaction turbine must always run full.
   c. When the load on a reaction turbine is decreased, the system reduces quantity of flow of water in an immersed flow reaction turbine and reduce the power produced.
   d. Pelton wheels are impulse turbine.

12. A positive displacement pump operates by:
   a. Imparting velocity to the fluid
   b. Trapping a fixed amount of fluid and displacing it.
   c. Using centrifugal force
   d. Using gravity

13. Cavitation can be minimized by:
   a. Increasing water temperature
   b. Reducing water pressure
   c. Increasing water pressure
   d. Reducing water velocity

14. The cross-flow turbine is also known as:
   a. Banki turbine b. Pelton turbine c. Francis turbine d. Kaplan turbine

15. What is the typical efficiency range for a well-designed Pelton turbine?
   a. 50-60% b. 60-70% c. 70-80% d. 85-90%

16. The Kaplan turbine is named after which engineer?
   a. James Kaplan b. Viktor Kaplan c. Francis Kaplan d. Thomas Edison

17. The force exerted by a jet on water on a stationary curved vane is maximum when the vane angle is:
   a. 90° b. 180° c. 0° d. 45°

18. The Turgo impulse was developed by
   b. James Turgo b. Viktor Turgo c. Gilkes Turgo d. Thoma Turgo

19. Which type of pump is suitable for high head and low flow rate applications?
   a. Centrifugal pump
   b. Axial flow pump
   c. Rotary pump
   d. Reciprocating pump

20. A slide gate is primarily used for:
   a. Regulating large flows
   b. Controlling small flows
   c. Emergency shut-off
   d. Measuring water level

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SECTION "B"
[8 Q. × 5 = 40 marks]

Attempt *ALL* questions. Assume a suitable value if any data is missing.

1. A wheel consists of radial blades with inner and outer radii of 360 mm and 720 mm respectively. Water enters the blades at the outer periphery with a velocity of 60 m/s and supply jet makes an angle of 25° with tangent to wheel at inlet tip. Water leaving the blade has the flow velocity of 12 m/s. If the blade angles at entrance and exit are 40° and 30° respectively, determine: [5]
   a. Work done per N of water,
   b. Speed of the wheel, and
   c. Efficiency of blading

2. Define impulse turbine and describe its suitability in the site. Describe the components of Pelton turbine with neat sketch? [2+3]

3. Calculate the diameter and speed of the runner of a Kaplan turbine developing 6000 kW under an effective head of 5 m. Overall efficiency of the turbine is 90%. The diameter of the boss is 0.4 times the external diameter of the runner. The turbine speed ratio is 2 and flow ratio 0.6. What is the specific speed of the turbine? [5]

4. Define pump. Explain the working of Reciprocating pump. [5]

5. Why governing of turbine is required? Suppose the load has been increased in the power plant. How will the governor work in this situation in case of Pelton turbine, explain? [1+4]

6. A reaction turbine works under a head of 25 m and produces 11800 kW while running at 120 r.p.m. The turbine has been installed at a station where atmospheric pressure is 10 m of water and vapour pressure is 0.2 m of water. Calculate the maximum height of the straight draft tube for the turbine. [5]

7. A turbine is to operate under a head of 25 m at 200 r.p.m. The discharge is 9 cumec. If the efficiency is 90%, determine the performance of the turbine under a head of 20 meters. [5]

8. What is hydraulic valves? Explain different types of Hydraulic valves used in different hydropower sites. [5]