

KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 314
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"
[10Q. × 0.5 = 5 marks]

Encircle the most appropriate answer.

1. For maximum efficiency of a series of curved vanes, the vane speed is
 - a. Equal to the jet speed
 - b. $\frac{3}{4}$ of the jet speed
 - c. $\frac{1}{2}$ of jet speed
 - d. $\frac{1}{3}$ of jet speed

2. An impulse turbine
 - a. Always operates submerged
 - b. Makes use of draft tube
 - c. Operates by initial complete conversion of pressure energy to kinetic energy
 - d. Converts pressure head to velocity head throughout the vanes.

3. Water turbines may be put in decreasing order of specific speed as
 - a. Propeller turbine, reaction turbine, impulse turbine
 - b. Pelton turbine, Francis turbine, Kaplan turbine
 - c. Reaction turbine, impulse turbine, propeller turbine
 - d. Impulse turbine, propeller turbine, reaction turbine

4. Which of the following statement is **CORRECT**?
 - a. Curves at constant speed are called main characteristics curves.
 - b. Curves at constant head are called main characteristics curves.
 - c. Curves at constant efficiency are called operating characteristics curves.
 - d. Curves at constant efficiency are called main characteristics curves.

5. The function of an impeller in a centrifugal pump is to
 - a. Convert the pressure energy into hydraulic energy
 - b. Convert the hydraulic energy into mechanical energy
 - c. Convert the mechanical energy into hydraulic energy
 - d. Transform most of the kinetic energies to pressure energy

6. Consider the following statements in the case of impulse turbine:
 - 1) The pressure and velocity both change as the water flows through the turbine.
 - 2) Pressure throughout remains atmospheric and the velocity alone changes.
 - 3) All the available energy is converted into kinetic energy.
 - 4) Water is admitted over the entire circumference of the runner.
 - 5) Water is admitted only through the nozzle.

Which of these statements are **CORRECT**?

- a. 2, 3 and 5
- b. 2 and 3
- c. 1, 4 and 5
- d. 1 and 4

7. Which of the following statement is **NOT CORRECT**?
- Cavitation forms where the local pressure drops up to the vapour pressure conditions due to increase in local velocity.
 - Cavitation takes place in turbine blades, runners of pumps, spillways where local velocity increases considerably.
 - Cavitation may be prevented by maintaining the ambient pressure relatively higher at probable points of occurrence by raising their levels.
 - Boundaries likely to be affected by cavitation can be protected against pitting by covering it with tough materials like stainless steel or rubber.
8. Which of the following statement is **CORRECT**?
- In an impulse turbine, the water impinges on the buckets with pressure energy.
 - In a reaction turbine, the water glides over the moving vanes with kinetic energy.
 - In an impulse turbine, the pressure of the following water remains unchanged and is equal to atmospheric pressure.
 - In a reaction turbine, the pressure of the following water increases after gliding over the vanes.
9. The overall efficiency for a Pelton wheel lies between
- | | |
|-----------------|-----------------|
| a. 0.5 to 0.65 | c. 0.75 to 0.85 |
| b. 0.65 to 0.75 | d. 0.85 to 0.90 |
10. Which of the following statement is **CORRECT**?
- In an impulse turbine, the water impinges on the buckets with pressure energy.
 - In an impulse turbine, the pressure of the following water remains unchanged and is equal to atmospheric pressure.
 - In a reaction turbine, the water glides over the moving vanes with kinetic energy.
 - In a reaction turbine, the pressure of the following water increases after gliding over the vanes.

SECTION "B"

[10Q. \times 0.5 = 5 marks]

Fill in the blanks with appropriate word/words.

- The reciprocating pumps are used for _____.
- If α is the blade angle at the outlet, then the maximum hydraulic efficiency of an ideal impulse turbine is _____.
- The movable wicket gates of a reaction turbine are used to _____.
- Efficiency of the jet of water having a velocity V and striking a series of vertical plates moving with a velocity u , is maximum when _____.
- Jet ratio (m) is defined as the ratio of _____.
- Unit power (P_u) is given by the expression _____.
- The specific speed of the pump is given by the expression _____.
- The cavitation in a hydraulic machine is mainly due to _____.
- The number of buckets on the periphery of a Pelton wheel is given by _____.
- In Kaplan turbine runner, the number of blades are generally between _____.

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Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

Course : CIEG 314
Semester : II
F.M. : 40

SECTION "C"
[5Q. × 8 = 40 marks]

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

1.
 - a. Explain the necessity to study the impact of jet on the plate in various scenarios. [4]
 - b. Describe the velocity triangle. Find the force exerted by the jet on a series of radial curved vanes. [4]
2.
 - a. Define available head in the Hydropower Project. Suppose you have two sites, one having impulse turbine and the another having reaction turbine, draw the labelled diagram showing the gross head and net head in each cases. [1+3]
 - b. In order to select Pelton turbine, what are the different criteria which should be taken into consideration? Explain different components of Pelton turbine. [1+3]
3.
 - a. What is cross flow turbine? Why it is mostly used in micro and mini hydropower projects. [2+2]
 - b. A Francis 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 for the turbine. [4]
4.
 - a. Why is governing of turbine srequired? Explain the working principle of oil pressure governor. [1+3]
 - b. A turbine extracts 45 metric horse power from the water flowing through it. The 30 cm diameter, 100 m long pipe has a friction factor of 0.02. Neglecting minor losses, determine the flow rate through the pipe and the turbine. (Take 1 hp (m) = 735.5 w) [4]
5.
 - a. Define priming of pump and why is it necessary? [1+2]
 - b. Enumerate the importance of hydraulic valve. Explain briefly about butterfly valve. [2]
 - c. The Kaplan turbine is running at 180 rpm under a head of 18 m. The hub diameter of Kaplan turbine is 0.42 times the diameter of the runner. If the vane angle of the extreme edge of the runner at outlet is 20° and the flow ratio is 0.15, determine the diameter of the runner and the hub, and discharge through the runner. Assume velocity of whirl at outlet is zero. [3]

