

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.E.

Year : III

Course : CIEG 314

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 18 FEB 2025

SECTION "A"

[10 Q. × 0.5 = 5 marks]

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

- The efficiency of a Pelton turbine is maximum when the velocity of the bucket is:
 - Equal to jet velocity
 - Half the jet velocity
 - One-third the jet velocity
 - Double the jet velocity
- Which of the following is not a characteristics of Pelton turbines?
 - High efficiency at high head
 - Simple design
 - Suitable for variable flow rates
 - High efficiency at low head
- Which type of pump is suitable for high head and low flow rate applications?
 - Centrifugal pump
 - Axial flow pump
 - Rotary pump
 - Reciprocating pump
- Tick mark the **CORRECT** statement
 - Curves at constant speed are called main characteristics curves.
 - Curves at constant head are called main characteristics curves.
 - Curves at constant efficiency are called operating characteristics curves.
 - Curves at constant efficiency are called main characteristics curves.
- The movable wicket gates of a reaction turbine are used to:
 - Control the flow of water passing through the turbine.
 - Control the pressure under which the turbine is working
 - Strengthen the casing of the turbine
 - Reduce the size of the turbine
- The cavitation in hydraulic machine is mainly due to
 - Low velocity
 - Low pressure
 - High pressure
 - High velocity
- The function of Draft tube in a reaction turbine is:
 - To enable the shaft of turbine to be vertical
 - To transform a large part of pressure energy at turbine outlet into kinetic energy
 - To avoid whirl losses at the exit of the runner
 - To transform a large part of kinetic energy at the turbine outlet into pressure energy
- Water turbines may be put in decreasing order of specific speed as
 - Propeller turbine, reaction turbine, impulse turbine
 - Pelton turbine, Francis turbine, Kaplan turbine
 - Reaction turbine, impulse turbine, propeller turbine
 - Impulse turbine, propeller turbine, reaction turbine

9. 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.
10. Governing of a turbine means
- The speed is kept constant under all conditions
 - The discharge is kept constant under all conditions
 - The speed and discharge is kept constant under all conditions
 - The head is kept constant under all working conditions

SECTION "B"

[10 Q. \times 0.5 = 5 marks]

Fill in the blanks with the most appropriate answer.

- For maximum efficiency of a series of curved vanes, the vane speed is _____.
- A Pelton wheel develops 1750 kW under a head of 100 meters while running at 200 r.p.m. and discharging 2500 liters of water per second. The unit power of the wheel is _____.
- The specific speed (N_s) of a water turbine is expressed as _____.
- If α is the blade angle at the outlet, then the maximum hydraulic efficiency of an ideal impulse turbine is _____.
- The overall efficiency for a Pelton wheel lies between _____.
- Jet ratio (m) is defined as the ratio of _____.
- The movable wicket gates of a reaction turbine are used to: _____.
- The specific speed of the pump is given by the expression _____.
- The number of buckets on the periphery of a Pelton wheel is given by _____.
- 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 _____.

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

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

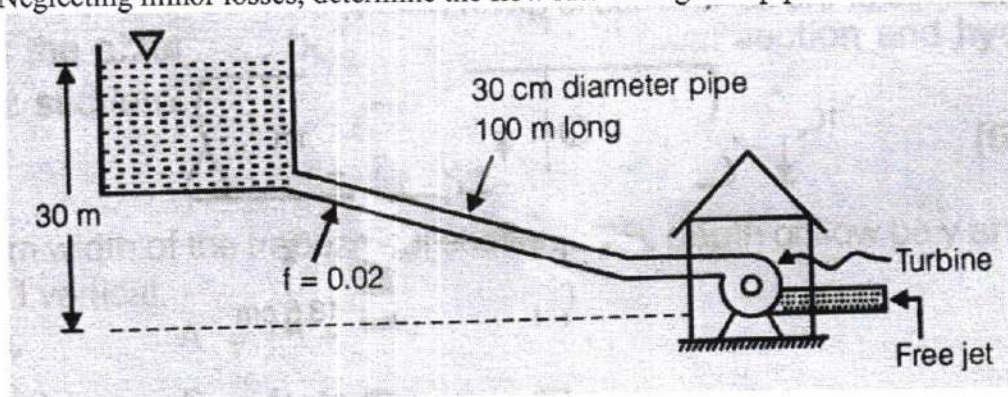
8 FEB 2025

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

SECTION "C"

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

1. A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 litre/sec under a head of 35 m. If the bucket deflects the jet through an angle of 160° , find the horse power and the efficiency of the turbine. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. [5]
2. What is governing of hydraulic turbines? Briefly explain the working of an oil pressure governor. [5]
3. The turbine shown in the figure below, 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. [5]



4. Derive an expression for unit speed, unit discharge and unit power. [5]
5. A turbine for the following site condition is to be designed. Head is 120 m, power produced = 5 x 120 MW. Number of turbines is 5. Head loss due to friction as 3% of the gross head. Length of the penstock is 1300 m each. Overall efficiency is 0.87. Number of pairs of poles is 18. Speed is 166.7 rpm. Breadth to diameter ratio is 0.3. The value of Darch-Weisbach f is 0.02. Determine the diameter of the penstock, runner and the type of turbine. The value of $\phi = 0.75$. [5]
6. Determine the maximum efficiency of flat plates mounted on the periphery of a wheel. [5]
7. What is draft tube and what are its different functions? Show that the pressure at the inlet of the draft tube is below atmospheric pressure. [2+3]
8. Explain different types of Hydraulic valves used in Hydropower sites. [5]