JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 3 EXAMINATION - 2023

B.Tech. - VII Semester (CSE/IT/ECE/BT/BI)

COURSE CODE (CREDITS): 22B1WCE733   MAX. MARKS: 35

COURSE NAME: Perennial Power Structures

COURSE INSTRUCTORS: Saurabh Rawat   MAX. TIME: 2 Hours

Note: (a)All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for

solving problems

Q1. A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water having velocity of 10.61 m/s from a penstock having a nozzle diameter of 0.3 m under a head of 38 m. The frictional losses occurring in the penstock 3m. If the bucket is deflecting the jet through an angle of 160°, find:
   a) The power of the jet striking the buckets
   b) Hydraulic efficiency of the Pelton wheel
Take the coefficient of velocity as 0.98.

(CO1, CO4, CO5) **[3+3 = 6]**

Q2. A single – basin type tidal power plat has a basin area of 2 km². The tide has an average range of 13 m. Power is generated only during the ebb cycle. The turbine stops operating when the head on it falls below 3m. Calculate:
   a) The average power generated by the plant in single emptying process of the basin for the turbine generator efficiency of 70%.
   b) Estimate the average annual energy generation of the plant.   *(CO3, CO5)* **[3+2 = 5]**

Q3. What is tracking in context of medium temperature solar power plants? With the help of a diagram explain the Solar Pond Technology. Also describe the variation of temperature and density within a solar pond. Explain the application of solar pond in exploiting the solar energy with the help of a diagram.   *(CO4)* **[1+3+2+2 = 8]**

Q4. A horizontal axis wind turbine with 30 m diameter produces 1.0 MW electricity at a wind speed of 60 kmph. Calculate the following:
   a) Blade – tip speed for a tip – speed ratio of 4.25
   b) Overall percent conversion efficiency of the wind energy to electricity by the wind turbine. Take air density = 1.225 kg/m³

(CO2) **[2+3 = 5]**

Q5. Explain the following:

    a) Difference between Flat Plate Collectors and Focusing Concentrators with respect to absorber area, efficiency, solar radiations exploited and flux on the absorber.

    b) Classification of Pelton turbine, Francis turbine, Kaplan turbine and Propellor turbine on the basis of discharge, head and specific speed.

(CO4, CO5) **[3+3 = 6]**

Q6. Derive the expression for 'Power of a water jet striking a curved moving surface'. Also prove that the maximum hydraulic efficiency for a 'Pelton Turbine' is achieved when the velocity of the moving blade = 2 × absolute velocity of the striking jet. *(CO2, CO4)* **[2.5+2.5 = 5]**