JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-3 EXAMINATIONS-2023

B.Tech.-VI Semester (Civil)

COURSE CODE (CREDITS): 18B1WCE639(3) MAX. MARKS: 35

COURSE NAME: Open Channel Flow and Hydraulic Machines

COURSE INSTRUCTOR: Saurabh Rawat MAX. TIME: 2 Hours

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

Q1. Derive the 'Momentum Equation' for a horizontal, frictionless, rectangular channel. Explain the use of the 'Momentum Equation' for drawing the specific force curve. For a hydraulic jump from depth 'y_1' to 'y_2', draw the specific energy and specific force curve and mark the corresponding alternate and conjugate depths. CO2, CO3 **[4]**

Q2. An overflow spillway is 50 m high. At the design head of 2.5 over the spillway, find the sequent depth and energy loss in hydraulic jump formed on the horizontal apron at the toe of the spillway. Neglect energy loss over the spillway, C_d = 0.74. Also find the percentage of energy loss occurred in hydraulic jump. Use specific energy concept to find the supercritical depth of flow of the hydraulic jump. *CO2, CO3* **[3+2=5]**

Q3. A hydraulic jump is formed in a 5 m wide outlet at a short distance downstream of the control gate. If the flow depth are 10 m and 2 m in the u/s and d/s respectively of the sluice gate for discharge of 150 m^3/sec, determine:

a). Flow depth d/s of the jump

b). Thrust on the gate

c). Head loss in the jump *CO3* **[2+2+1=5]**

Q4. A single jet Pelton turbine is required to drive a generator to develop 10000 kW. The available head at the nozzle is 760 m. The mean bucket velocity is 0.46 time the jet velocity

and the relative velocity at exit is 0.85 time the inlet relative velocity. The other available information is as follows:

Mechanical efficiency = 95%; Wheel efficiency = 87%; Deviation angle is 165°; Coefficient of velocity for nozzle is 0.97. Find

a). Diameter of jet

b). Flow in cumecs

c). Force exerted by the jet on the buckets *CO4* **[1+1+3=5]**

Q5. The depth and velocity of flow in a rectangular channel are 0.9 and 1.5 m/s respectively. If the gate at the downstream end of the channel is closed suddenly, what will be the height of absolute velocity resulting surge. *CO3* **[6]**

Q6. A wide rectangular channel carries a discharge intensity of 4 m^3/s per meter width. The longitudinal slope of the channel is 0.0005. Determine the GVF profile produced by a sudden drop in the bed of channel. Assume Manning's n = 0.025. *CO1, CO2, CO3* **[4]**

Q7. Prove that $\eta_{system} = f\left(\frac{u}{v_1}\right)$. Determine the value of speed ratio $\left(\frac{u}{v_1}\right)$ for which η_{system} will be maximum. Also determine the value of $\eta_{system(max)}$.

CO4 **[3+2+1=6]**